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STUDIES ON HOME RANGE IN THE BROWN RAT[1]

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Although the brown rat (*Rattus norvegicus*) is an ubiquitous pest throughout the world, few studies of its home range and movements have been conducted. It is common opinion that rats are extensive wanderers and frequently cover large areas. Furthermore, eruptions and emigrations of hordes of rats are commonly reported, but detailed reliable evidence is largely lacking. Seasonal movements to and from farm buildings have been reported frequently, but again detailed evidence is lacking. The aim of this paper is to describe observations and experiments designed to determine the extent of home range of rats and also to indicate some of the circumstances which induce rats to wander.

Home range is the term commonly used to designate the area regularly frequented by an individual. Its size may vary from season to season, according to sex, or to population density. Many species of mammals have a home range. For large carnivores the home range may cover many square miles while for some rodents it is only a fraction of an acre. For some species a band or group may have a home range as for example the howler monkey (Carpenter, 1934). Burt (1940) reviewed the problem for small mammals and summarized the data showing that several species have a very limited area. Blair (1942) found that the woodland deermouse (*Peromyscus maniculatus gracilis*) had a home range of 2.31 acres for the male and 1.39 acres for the female, while the prairie deermouse, *P. m. bairdii*, (Blair, 1940) had a range of 0.63 acres for the male and 0.61 acres for the female. Hamilton (1937) found the home range of the meadow vole (*Microtus*) seldom to be more than 0.7 acres. The adult female cottontail, *Sylvilagus*, (Haugen, 1942) has a home range of 140 acres in the winter and 22.5 acres in the breeding season. Adult males wander far and each may have a home range of 100 acres. The opossum, *Didelphis*, (Lay, 1942) has a home range in Texas of between 11 and 38 acres and the males seem to wander more than the females. Several species of Brazilian rodents and marsupials (Davis, 1945) live in a limited area and two species of English mice (Evans, 1942) restricted their activity to

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home ranges with diameters of 100 yards and 60 yards, respectively. From these reports it is clear that many mammals, especially rodents, live in restricted areas.

For commensal rats, only limited data are available. Petrie and Todd (1923) found that *Rattus rattus* in Egypt lived in a very restricted area. Of 146 rats marked, released, and recaptured during three months, only one left its own city block, and only fifty-three were caught in a different house. Petrie and Todd also studied the movements of another commensal rodent, *Acomys cahirinus*, and found an even more limited home range.

Creel (1915), in New Orleans, liberated a large number of marked rats in two central localities and recaptured some as far as four miles away. This experiment, however, indicates nothing about the home range of rats since all rats were liberated in a place strange to them. Since Creel does not state how many unmarked rats were captured nor how the collections were organized, his data cannot be analyzed now. However, it is clear that when liberated in a strange place rats may wander long distances since twenty-one of the one hundred and three rats recaptured were found two to four miles from the place of liberation.

Hirst (1926–27) found very limited movement of rats associated with plague. He says, "*Rattus rattus kandianus* is not in the habit of wandering more than the shortest distance from its habitual haunts" and in speaking of brown rats he states that there is "no evidence that this species (*Rattus norvegicus*) migrates far from the channels and burrows where it lives."

Venables and Leslie (1942) noted a 27-foot rat run between buildings and corn ricks and that the brown rats ran freely from one rick to another. From their map it appears that the home range of these rats had a diameter of about thirty-five feet.

Audy (1947) concluded that, since rats (*Rattus rattus*) in New Guinea have striking local differences in the ectoparasitic fauna, the individual rats have a very limited range.

The functions or uses of the home range vary for different species. The home range is the area frequented by the individual and does not imply the necessity of defense or exclusive possession which is characteristic of territory as reviewed by Nice (1941) for birds and by Burt (1940) for mammals. The protection of food supply, nest site, or sex partner is frequently the function of territory. In addition, we suggest that another function of home range or territory may be protection against predators resulting from an intimate acquaintance with the home range. Thus an individual that knows every hole, bush, or shelter probably will escape enemies better than an individual unacquainted with the area. It is regularly observed that rats and other rodents released unharmed in their own home range immediately find a hole or shelter, but that rats released in a strange environment frequently spend considerable time dashing about before finding shelter.

If knowledge of the local surroundings is of significance in protection then an evolutionary mechanism for the selection of individuals which have an innate disposition to remain in a home range is possible. According to this hypothesis,

the individuals which tended to remain in a home range would be less susceptible to predation and hence on the average would survive longer than individuals which did not tend to remain in a home range.

Extent of home range as indicated by marked rats.—In order to obtain information about the movements of individual rats, several experiments were conducted in blocks in the city of Baltimore and on a nearby farm. The basic procedure was to trap rats in box traps (Richter and Emlen, 1945), mark each rat by clip-

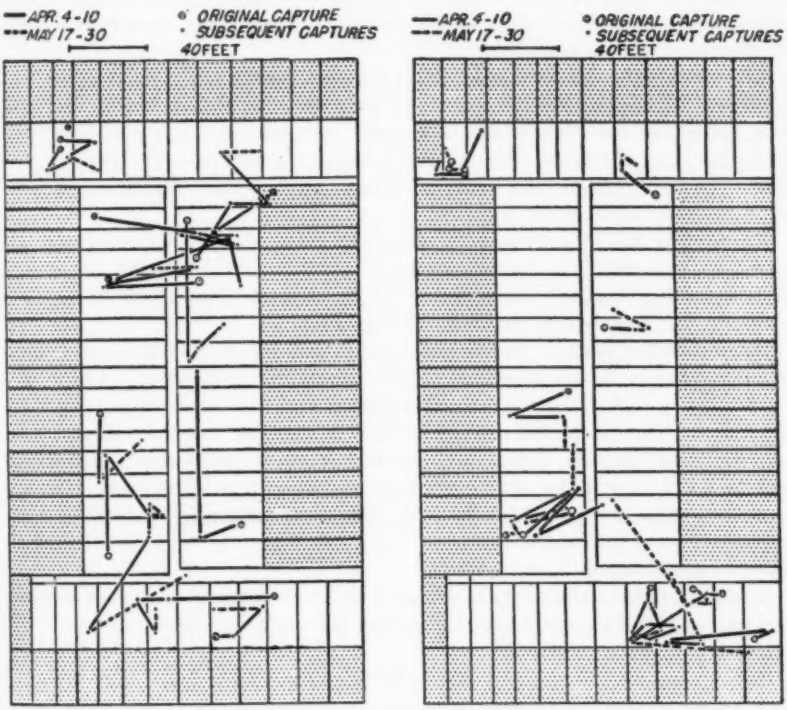

FIG. 1.—Movements of thirteen males (left) and twelve females (right), captured more than three times (see experiment 2).

ping certain toes, obtain data about weight, sex, and reproductive state, and then release the rat at the point of capture. The rats were recovered after an interval by trapping or poisoning. Four experiments were conducted in city blocks and one on a farm. The details of each experiment varied as described below. The city blocks are long with central alleys. A solid line of "row-houses" face each street (Figs. 1 and 2). Nearly all houses have yards and only a few yards are completely isolated by solid stone or brick walls.

Experiment 1.—On 30 October 1943, thirty-five native rats were trapped, marked, and released in a city block. One month later trapping was again be-

gun and continued until 15 January 1944. All trapped rats were removed from the block on the day of capture. From 11–18 April 1944, the remaining rats were poisoned or gassed and as many as possible picked up. Also, at this time, the rats in the block to the north and in the block to the east were poisoned and gassed. It will be noted that by this killing procedure only two records can be obtained for each rat.

Of the thirty-five rats marked and released on 30 October, twelve were recaptured, in the retrapping period (30 November–15 January), from a total of 162 rats trapped. One marked rat was recovered by poisoning in April from a total of fifty-two rats recovered.

All marked rats were recovered within a short distance of the point of original capture. Three males and four females were recovered within thirty feet and four males and two females were recovered between thirty-five and sixty feet from the place of release. No rat was recovered more than sixty-five feet distant. In the adjacent blocks to the north and east, fifty-three rats, none marked, were recovered after poisoning.

Experiment 2.—In another city block rats were trapped, marked, and released for a week (4–10 April 1944) and then left unmolested for six weeks. Rats were then trapped and removed from the block from 15–30 May 1944. Trapping was followed by poison on 27 July 1944.

During the first period, 128 rats were marked and released. Sixty-two of these individuals were recaptured a total of 186 times within this period. In the second trapping period, forty-seven marked individuals were captured out of a total of 110 rats. Two additional marked individuals were found out of a total of nine rats recovered after the poisoning. Figure 1 shows the movements of thirteen females and twelve males which were captured more than three times. No rat was captured more than 120 feet from site of original capture and only three were recaptured more than eighty feet away. Note in Figure 1 that males tended to move longer distances than females.

All eight blocks immediately surrounding the experimental block were trapped and poisoned at the same time. No marked rat was found out of a total of 410 trapped and twelve poisoned rats.

Experiment 3.—In another city block eighteen native rats were marked and released (11–12 November 1943) in three back yards. Rats were then trapped in the entire block from 19 November–17 December 1943. In a total of 223 rats captured, ten marked rats were recovered, all within eighty feet of the point of original capture.

Experiment 4.—In February, 1946, an experiment was begun to obtain information on ability to return ("homing") as well as the extent of home range. For this purpose was chosen a row of three blocks, extending roughly from north to south, and having the alleys also extending in the same direction. Figure 2 shows two of these blocks placed side by side, but actually the right hand block is located below (south of) the left hand block. Hence, on 15 February 1946, marked rats from the north and south blocks were liberated in the central block. From then on at frequent intervals rats were trapped, marked, and released at

the point of capture. Beginning 16 April, snap traps, steel traps, and poison were used to obtain more records of marked rats. The results in reference to "homing" will not be discussed here. The data for these blocks are given in Table 1 according to size and sex. One hundred eighty-one rats were marked and fifty-three (29 per cent) of these were recovered in a subsequent week.

TABLE 1.—*Numbers of rats released and recaptured in three blocks*

	ADULTS, WT. 250 GRAMS OR MORE		YOUNG, WT. LESS THAN 250 GRAMS		TOTAL	WEEK	DATES
	Males	Females	Males	Females			
Trapped, marked, and released							
Released	30	32	9	5	76	1	February 15–16
Recaptured	(5)*	(4)	0	0	(9)		
Released	11	5	10	11	37	2	February 19–22
Recaptured	6	3 (1)	3 (1)	0	9 (2)		
Released	11	15	2	5	33	4	March 6–8
Recaptured	0	3	1	1	5		
Released	7	4	5	9	25	6	March 19–22
Recaptured	3 (1)	4	0	0	7 (1)		
Released	3	4	1	2	10	8	April 3–5
Recaptured	1	1	1	1	4		
Trapped and killed or poisoned							
Unmarked new rats killed	8	1	2	1	12	10	April 16–20
Recaptured	1	7	0	0	8		
New rats	7	5	2	6	20	11	April 24–27
Recaptured	4	2	1	0	7		
New rats	2	4	4	3	13	12	May 1–4
Recaptured	4	4	0	0	8		
New rats	1	1	0	2	4	13	May 6
Recaptured	0	2	0	0	2		
Total released	62	60	27	32	181		
Total recaptured	19	26	6	2	53		
Per cent recaptured	31	43	22	6	29		
Killed	18	11	8	12	49		

* Numbers in parentheses refer to rats recaptured again during the same week of original capture. Numbers without parentheses refer to rats marked in a previous week and recaptured.

Twice as many adults as young were released and the number of each sex was about equal. As indicated by the figures in parentheses, twelve rats were recaptured again in the same period as released.

The movements according to age and sex of recaptured rats are shown in Figure 2. From the map it may be noted that more adult male than female rats were captured away from the yard of original capture. The one rat which changed blocks was a large female (Fig. 2).

To summarize the results of these four experiments: Adult male rats traveled the following distances: 0–20 feet, twenty-one; 25–40 feet, eleven; 45–60 feet, nine; 65–80 feet, one; 105–120 feet, two. Young males (weight less than 250 grams): 0–20 feet, ten; 25–40 feet, one; 65–80 feet, one; 85–100 feet, one. Adult females: 0–20 feet, thirty-one; 25–40 feet, eleven; 45–60 feet, seven; 65–80 feet, three; 105–120 feet, one; 345–360 feet, one. Young females: (weight less than 250 gms.) 0–20 feet, three; 25–40 feet, three; 85–100 feet, one.

TABLE 2.—*Numbers of rats released and recaptured on farm*

SEASONS		RELEASES OF RATS				RECAPTURES OF RATS				INDIVIDUALS RECAPTURED				INDIVIDUALS RELEASED			
Periods	Dates	Male		Female		Male		Female		Male		Female		Male		Female	
		ad	yg	ad	yg	ad	yg	ad	yg	ad	yg	ad	yg	ad	yg	ad	yg
1–3	Mar. 26–May 2	63	12	71	19	49	9	64	7	23	6	32	8	47	11	53	19
4–6	May 14–June 15	72	69	*126*	80	47	40	*66*	56	22	24	*37*	31	53	59	*82*	64
7–10	June 25–Aug. 10	106	76	115	80	30	32	35	62	14	22	25	30	55	62	61	64
11–13	Aug. 20–Sept. 21	73	59	100	64	43	31	33	23	20	20	20	15	36	43	47	44
14–16	Oct. 1–Nov. 2	46	68	65	81	13	33	22	63	10	20	13	27	15	48	32	56
17–19	Nov. 13–Dec. 14	61	39	44	39	11	13	5	3	5	12	5	3	16	28	12	18
20–26	Dec. 30–Mar. 21	74	30	71	27	13	9	11	5	9	6	10	4	25	19	29	14
Totals		495	353	592	390	206	167	236	219	109	110	142	118	247	270	316	279

TABLE 3.—*Frequency of recaptures of rats on farm*

TIMES RECAPTURED	ADULT MALE		YOUNG MALE		ADULT FEMALE		YOUNG FEMALE	
	Freq.	Per Cent	Freq.	Per Cent	Freq.	Per Cent	Freq.	Per Cent
1	59	54	75	68	89	63	66	56
2	27	25	20	18	31	22	29	25
3	11	10	10	9	13	9	10	10
4	5	5	3	3	4	3	6	4
5	4	3	2	2	4	3	3	2
6	1	1	0	0	0	0	2	1
7	2	2	0	0	0	0	2	2
Total Rats	109	100	110	100	142*	100	118	100
Total Recaptures	206	—	167	—	236	—	219	—
Average	1.89	—	1.52	—	1.66	—	1.85	—

* One female recaptured ten times.

Experiment 5.—Studies of the home range of rats were conducted on a farm. The first group of rats was marked and released on 26 March 1946. Trapping was conducted at two-week intervals (Table 2). The last trapping period was from 12–15 March 1947. From 18–26 March 1947, the rats were caught in steel and snap traps and removed. The farm consists of numerous stables for breeding and boarding race horses. In addition, there was a garage, cow barn, machine

shop, and some chicken coops. The buildings are of wood or stone and provided ample harborage in the walls and lofts. The map (Fig. 3) shows the location of the buildings. About 80–100 box traps were set daily for three to five days depending upon weather and trapping success. Unfortunately, traps could not be set in some of the best places because of interference by domestic animals. Everywhere there was ample food consisting of manure and horse feed. Because of the numerous places unavailable for trapping and the abundant supply of other food, the number of rats captured was relatively small.

The procedure consisted of trapping, marking by clipping toes, and releasing at the point of capture. The trapping was conducted on alternate weeks which were numbered and called "periods." The periods were grouped for analysis into seven "seasons" which were based on the rainfall and temperature. Table

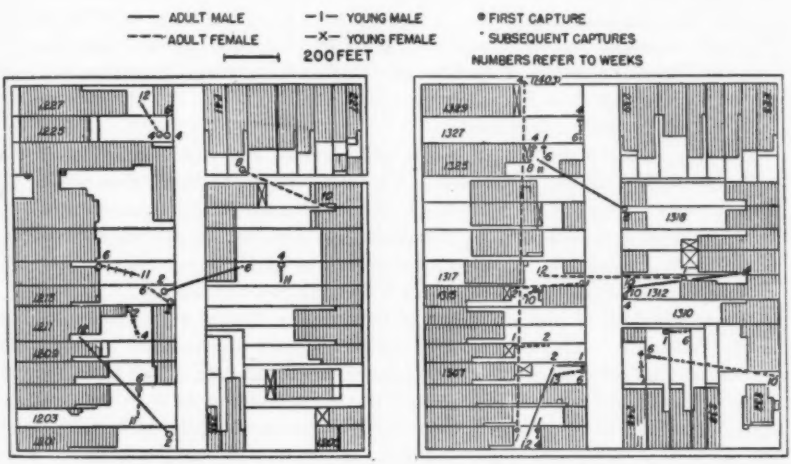

FIG. 2.—Recaptures of rats in two blocks (see experiment 4)

2 shows the periods grouped into seasons, inclusive dates, and the numbers of rats handled according to sex, age, and season. Female rats weighing more than 149 grams were grouped together and termed adult because nearly all such rats had a perforate vagina. Male rats weighing more than 174 grams were considered adult because nearly all such rats had scrotal testes. (The farm rats were much smaller than the city rats.) The column "Releases of Rats" includes all rats released; "Recaptures of Rats" includes all rats recaptured and marked rats found dead. These two columns thus may include the same individual several times. "Individuals Released" and "Individuals Recaptured" includes each rat only once. Thus, for example, in periods 4–6, thirty-seven marked adult female rats were recaptured a total of sixty-six times and eighty-two individual adult females were released 126 times. During the experiment, 352 dead rats were found, many of which were marked.

The frequency of recaptures for the individual rats are given in Table 3. No rat was recaptured more than ten times and the average number of recaptures was less than two for all age and sex groups.

There are two methods of measuring the distances of recaptures: (1) assume that the place of original capture is the base and measure all movements from there, (2) measure each movement from the place of last capture. Method (1) is preferred here because it gives a better measure of distances of recaptures. Thus, consider a rat which was captured at a certain spot, then at a place twenty-five feet away, and again back at the original place. Method (1) records this as one movement of 20–39 feet and one of 0–19 feet. Method (2) would record this as two movements of 20–39 feet. In the present study, for purposes of indicating movement, it was assumed that the original place of capture was the origin and all movement was measured from there. The movements are divided into distance categories for recaptures within the same building where originally captured and for buildings different from original capture, and recorded according to the number of periods since original capture. However, six rats obviously changed their home ranges to another building. In these cases the base was changed for calculations.

The movements of some adult males that traveled long distances or had a specially interesting history are shown in Figure 3. This, of course, does not represent average movement. For example, an adult male (Fig. 3) was captured in the upper barn in periods 5 and 7, in a drain pipe in period 10, and then in the crib in periods 14, 22, and 23. This rat apparently changed its home range. Another rat lived in the lower barn for periods 6–24 (thirty-seven weeks).

An examination of the summary of movements (Table 4) indicates several points of interest. The movement of the adult males and females is about the same since 75.3 per cent of 206 adult males and 84.0 per cent of 236 females were recaptured within forty feet, and about the same numbers of each sex were recaptured in different buildings. The young rats showed similar movement since 82.6 per cent of 167 young males and 88.0 per cent of 219 young females were recaptured within forty feet. Very few young females were recaptured in different buildings. The differences between adult males and adult females are not statistically significant.

The data on the tally sheets were also analyzed to determine if there was any difference in movements between seasons. Table 5 shows the recaptures of rats within the same season according to distances within the same building and also compares the recaptures in the same building with the recaptures in different buildings. In order to compare the figures, the ratio of the recaptures between 0–19 feet and 20–39 feet are calculated. There is no consistent trend in the ratios and it is concluded that the distances moved (area of home range) of rats do not change with seasons. However, the rats may change the location of home range somewhat. It was observed that the rats seldom left the buildings in the winter, but in summer they regularly went a few feet outside. Also, during three weeks of dry weather, the rats in the crib went out into the grass about twenty feet to get water from a ditch.

Snap traps were set in hedgerows about 200 yards away from the buildings for about 900 trap-nights in the summer. During this time four rats were caught. Two had been marked in the farm buildings. A young male was caught in the

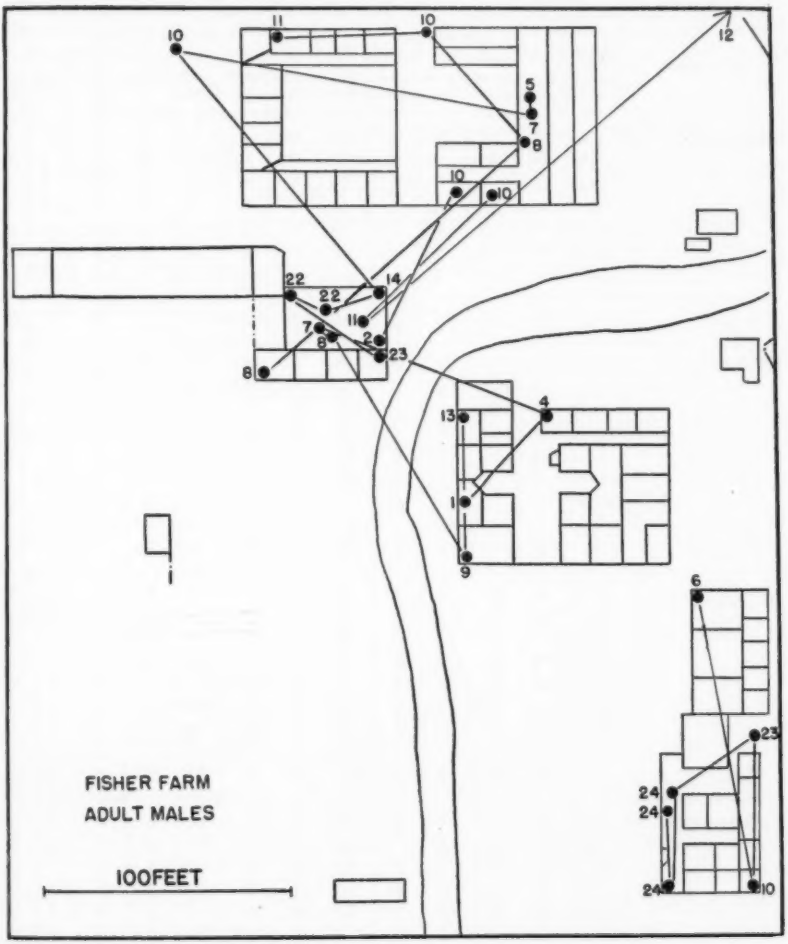

FIG. 3.—Movements between farm buildings, adult males. Numbers refer to periods of capture.

fencerow in June and a young female moved to the fencerow in September. In September some rats appeared across the highway at some pig troughs which were temporarily placed there. Although the number of rats moving long distances is about the same from season to season (Table 5), during the summer the rats may

go out into fields whereas during the winter they move from building to building. These long distance movements do not represent home ranges, but may be shifts

TABLE 4.—*Distances in feet of recaptures of rats according to sex, age, and seasons*

SEX AND AGE	SEASON RELEASED	SAME BUILDING					DIFFERENT BUILDING						
		0–19 feet	20–39 feet	40–59 feet	60+ feet	Total Rats	20–39 feet	40–59 feet	60–79 feet	80–99 feet	100–149 feet	150+ feet	Total Rats
Male adult	1–3	10	23	10	0	43	0	2	2	1	1	0	6
	4–6	16	16	6	3	41	1	0	1	2	1	1	6
	7–10	17	6	0	1	24	0	0	2	4	0	0	6
	11–13	11	25	5	0	41	0	0	0	0	2	0	2
	14–16	5	5	2	0	12	0	0	1	0	0	0	1
	17–19	2	8	0	0	10	0	0	0	0	0	1	1
	20–26	5	6	0	0	11	1	0	0	0	1	0	2
Total		66	89	23	4	182	2	2	6	7	5	2	24
Male young	1–3	3	3	1	0	7	0	0	0	0	0	2	2
	4–6	16	15	3	0	34	0	0	0	3	2	1	6
	7–10	13	12	1	0	26	0	0	0	3	3	0	6
	11–13	11	17	1	1	30	0	0	0	0	1	0	1
	14–16	12	19	1	0	32	0	0	0	0	1	0	1
	17–19	5	6	1	0	12	0	0	0	1	0	0	1
	20–26	7	2	0	0	9	0	0	0	0	0	0	0
Total		67	74	8	1	150	0	0	0	7	7	3	17
Female adult	1–3	27	23	2	3	55	0	0	2	0	1	6	9
	4–6	19	39	5	0	63	0	0	1	0	1	1	3
	7–10	8	19	4	0	31	0	0	1	1	0	1	4
	11–13	8	18	2	0	28	0	1	0	2	0	2	5
	14–16	9	13	0	0	22	0	0	0	0	0	0	0
	17–19	2	3	0	0	5	0	0	0	0	0	0	0
	20–26	3	7	0	0	10	0	0	0	0	0	1	1
Total		76	122	13	3	214	0	1	5	3	2	11	22
Female young	1–3	2	3	2	0	7	0	0	0	0	0	0	0
	4–6	28	20	2	0	50	0	2	3	0	1	0	6
	7–10	24	27	6	2	59	0	0	0	2	0	1	3
	11–13	12	10	1	0	23	0	0	0	0	0	0	0
	14–16	33	26	2	1	62	0	0	0	0	0	1	1
	17–19	3	0	0	0	3	0	0	0	0	0	0	0
	20–26	5	0	0	0	5	0	0	0	0	0	0	0
Total		107	86	13	3	209	0	2	3	2	1	2	10

of location of home range. It should be emphasized that movements from buildings to fields on this farm were not organized emigrations, but merely the results of wandering, which occurs at all seasons. In the summer rats can live in the

hedgerows, and a few appear there, but in the winter they cannot live there. There is no evidence of a concerted seasonal movement to and from the fields as is often reported in anecdotes.

Twenty-four sick rats were recaptured. The cause of illness in most cases was apparently *Salmonella typhimurium*. Movements for all ages, sexes, and seasons were determined by trapping. Of the twenty-four sick rats recaptured, 29.2

TABLE 5.—*Recaptures of rats within the same season*

SEX AND AGE	SEASON	COMPARISON OF MOVEMENTS WITHIN BUILDING			COMPARISON OF MOVEMENTS BETWEEN BUILDINGS	
		Recaptured Within		Ratio	Building Where Recaptured	
		0-19 ft.	20-39 ft.		Same	Different
Male adult	Prevernal	9	9	1.00	21	1
	Vernal	7	8	.88	15	3
	Estival	7	3	2.33	8	2
	Postestival	6	8	.75	14	1
	Serotinal	1	2	.50	3	0
	Autumnal	1	6	.17	7	1
	Hibernal	5	6	.83	11	2
Male young	Prevernal	2	3	.66	6	1
	Vernal	9	3	3.00	13	1
	Estival	6	4	1.50	10	1
	Postestival	10	10	1.00	20	0
	Serotinal	4	10	.40	15	0
	Autumnal	3	2	1.50	5	1
	Hibernal	6	1	6.00	7	0
Female adult	Prevernal	18	7	2.58	27	6
	Vernal	11	11	1.00	24	1
	Estival	4	4	1.00	9	2
	Postestival	5	4	1.25	9	4
	Serotinal	2	5	.40	7	0
	Autumnal	1	1	1.00	2	0
	Hibernal	0	6	—	6	1
Female young	Prevernal	1	0	—	3	0
	Vernal	15	8	1.87	24	2
	Estival	11	4	2.75	19	0
	Postestival	8	2	4.00	11	0
	Serotinal	20	13	1.54	35	0
	Autumnal	3	0	—	3	0
	Hibernal	3	0	—	3	0

per cent were in a different building in contrast to 8.3 per cent of the well rats. Also there is a suggestion of greater movement by the sick rats within the same building.

These studies of movements of rats on the farm agree with studies in urban areas and indicate that rats live within a restricted area. Under changing conditons some rats may travel considerable distances.

Experiment 6.—In addition to observations upon the home range of rats in the city blocks and in farm buildings some experiments were carried out on an island where the rats lived both in the farm buildings and in the fields, banks, and hedgerows. A small number of rats was marked in April and recaptured three weeks later both in the buildings and in the fields. All three recaptured adult males were caught within forty feet of original capture. Only two of the nine recaptured adult females were recovered more than forty feet from place of original capture.

On this island, in the month of September when the ripe corn was still in the fields, the rats made three runways, each 375–400 yards long, from the banks and farm buildings to the field. The rats lived in the banks or under the farm buildings and commuted the whole distance to the corn field for food. Under these conditions the home range consisted of a small living area and a feeding area connected by a long narrow trail.

Extent of home range as indicated by the recovery of decimated rat populations.—In a study of the growth of rat populations after poisoning (Emlen, Stokes, and Windsor, 1948), many observations were made which help to clarify our concept of the extent of movements of rats.

(1) The recovery of the populations in these blocks followed a logistic curve of growth and did not show a rapid initial increase as would be true if rats invaded the block.

(2) From another viewpoint, the study of recovery of rat populations is indicative of the amount of movement. If invasion were important, then rat populations in decimated blocks adjacent to heavily infested blocks should recover rapidly. When data concerning the rate of recovery in relation to the numbers of rats in blocks to the north and south were analyzed (these blocks are used because of the design of the alleys, see Emlen, *et al.*, 1948), it was apparent that the numbers of rats in adjoining blocks were unrelated to the speed of recovery. Again it seems that invasion must be a small factor in population growth.

(3) Still additional data about the movements of rats can be obtained by comparing the increase in the number of rats in colonies located at the ends of blocks and in the center of blocks. If invasion into decimated blocks is negligible then centrally located colonies would recover at the same rate as terminally located colonies. The per cent recovery eight months after reduction was 42 for terminal and 43 for central colonies, showing this to be the case. The proximity of a thriving colony of rats also had little influence upon the rate of recovery of a decimated colony. Indeed the distance of seventy-five feet acted as a barrier to re-occupation of depopulated colony sites in the same block.

(4) One block which had many rats and was freed of rats in March, 1943, remained free of rats until August, 1945,—a total of twenty-nine months. The nearby blocks all had small rat populations which were kept low by poisoning and trapping. It is clear that rats did not enter this one block frequently or the block would have become infested sooner. Conditions for rats were suitable for when rats did become established, the population increased to 131 within a year.

Extent of home range as indicated by rat signs.—In studies of the dynamics of

rat populations, more than 350 detailed maps have been prepared to show the rat signs in city blocks. These maps indicate the presence of droppings, tracks, runways, and burrows in each yard. In heavily infested blocks nearly every yard has signs, but in many blocks the signs are grouped into small areas. The rats clearly live in colonies which are frequently isolated. The unpopulated space between colonies may be lacking in food or harborage or it may appear to be suitable for rats. In any case, it is obvious that rats tend to live in colonies which extend over a limited area.

An examination of the maps shows many colonies which are separated from the other colonies in the block. The area of a colony is usually around 2500 square feet (about fifty-five feet in diameter) and the distance to the nearest colony may be as short as forty feet or as long as 150 feet. These observations point to the conclusion that an individual rat lives within a restricted home range.

Extent of home range as indicated by tracks in snow.—During the course of three winters, seventy-four snow surveys were made in forty residential blocks for the purpose of determining movements. Maps were made showing all tracks in yards, alleys, sidewalks, and surrounding streets. As far as possible the maps were made early in the morning following the snowfall and before tracks had been confused by melting and by human footprints. Where populations were high the trails of individual rats were often indistinguishable. Where populations were low the movements of individuals could often be traced in detail.

Thirty-six of these blocks consisted of row houses separated by alleys running the length of the blocks (Fig. 4). Here food was usually plentiful around garbage cans and exposed trash piles.

Four other blocks consisted of houses with a space of twenty feet separating each unit (Fig. 5). The spaces below the front porches were enclosed with lattice work and provided excellent rat harborage. Garbage was excellently kept and the only sources of food were spillage following collections and left-over pet and bird food. Where the number of rats in a block was small, usually less than fifty, it was often possible to follow the trails of individual rats. For the most part the trails mapped represented minimum ranges, since almost invariably there were areas bare of snow at the rear of houses as well as on the lee side of walls and fences.

In the thirty-six blocks of row houses, the trails of individual rats were often indistinguishable, but it was possible to get fairly accurate measurements of the total extent of isolated colonies. Seven colonies occupied a space 0–25 feet in length; twelve colonies, 26–50 feet; five, 51–75 feet; five 76–100 feet; one, 101–150 feet; and one, 151–200 feet. Of these colonies, 94 per cent had an extent of 100 feet or less, a distance equal to about one-third of the length of the entire block. Of the sixty-six surveys made in these blocks, there was only one record of a rat having crossed from one block to another. At the rate of one crossing to sixty-six surveys an individual block would be subject to rat invasion only once in sixty-six days. This would not be a significant factor in the population mechanics of that block.

The alleys, which vary in width from 8–18 feet, and which run the length of

the blocks, seem to act as barriers limiting the range of rats. In twenty-one surveys where particular attention was paid to tracks in the alleys and where the snow was fresh, there were forty-two trails leading from one side of the alley to the other. Some of these represented repeated crossings by the same rat. There

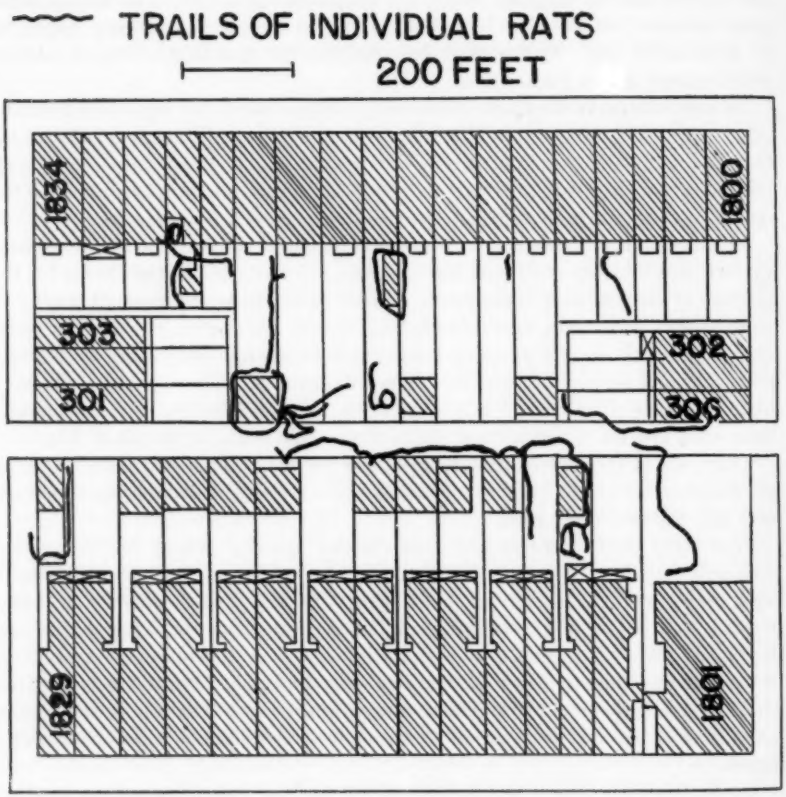

FIG. 4.—Trails of rats in snow in a block of row houses (houses shown by lines, garages and sheds by large cross).

were an estimated 500 rats in these blocks, so in any one night there would be less than 10 per cent of the rats crossing this barrier.

Eight surveys were made in the four blocks of single houses. From the tracks it was found that in ten cases rats crossed from one block to the next. In every case such crossings were a continuation of a porch-to-porch movement (Fig. 5). Here rats were presumably ranging longer distances because of the scarcity of food due to good sanitary conditions.

Extent of home range as indicated by dyed feces.—Additional evidence giving in-

formation about movements of rats was obtained by supplying food containing a dye which subsequently showed up in the rat feces. Bait stations were set up in various blocks and ground corn or rolled oats left for a week so that rats of that vicinity would be feeding there regularly. Then feed containing 0.2 per cent methylene blue was placed at the bait station. After all old feces were destroyed, maps were made on successive days to show location of all blue and normal feces. Their distribution was not always the same on successive nights and after two weeks of feeding, blue feces were found over a somewhat larger area than at first. In five blocks, the relation between distance from bait station and percentage of

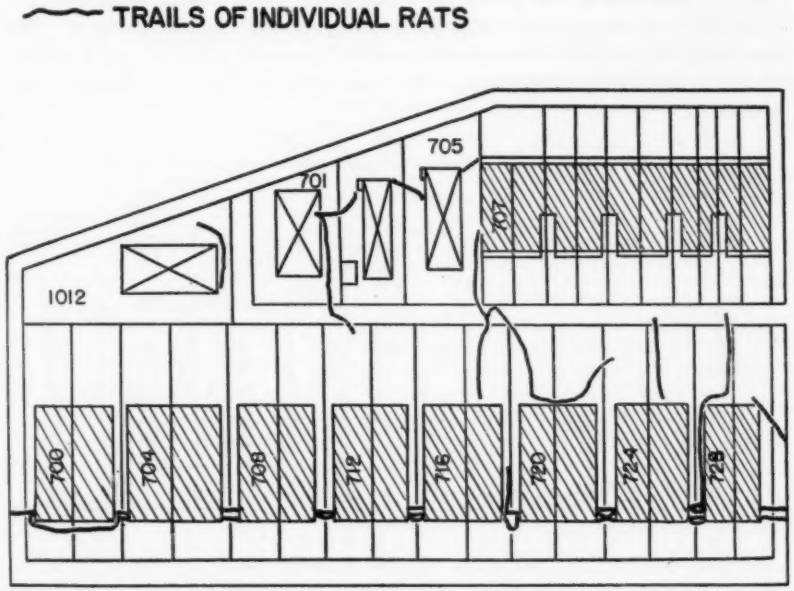

FIG. 5.—Trails of rats in snow in a block of single houses

feces that were blue was: 0–24 feet, 80 per cent; 25–49 feet, 34 per cent; 50–74 feet, 15 per cent; 75–99 feet, 5 per cent. Table 6 shows the relation of numbers of blue feces to increasing distance from the bait station. It will be seen that almost all of the blue feces (97 per cent) were found within seventy-five feet of the bait station. Taking the greatest distance between blue feces as the maximum range of the group of rats feeding at the bait station, one sees that it never exceeded 150 feet. With very few exceptions almost all blue feces were found on the same side of the alley as the bait station. This was particularly noticeable in the block shown in Figure 6. There were 132 blue feces on the bait side of the eight-foot alley as compared with only one on the opposite side. Thus, even such a narrow open area can act as a limitation to rat movements.

Discussion.—The results of these investigations indicate the extent of movements of brown rats. The area inhabited by an individual is called the home range and it is usually assumed that the individual frequents most or all of this area. However, some species, such as the pocket gopher, *Geomys* (Mohr, 1947), inhabit tunnels or runways and thus do not frequent an area but really use a series of trails. Other species such as field mice probably actually use only a small part of the area of their home range. The calculated size of the home range therefore depends greatly upon the configuration of the terrain and the course of the trails. For brown rats it is clear that the individuals use regular runways to get from place to place and do not utilize the whole area. For example, a rat may live under the steps, run along the fence to the alley, and there feed on garbage. The home range may consist of a very narrow strip connecting a feeding and a harborage area. An areal measurement of the home range in these cases is practically meaningless.

TABLE 6.—*Number of blue feces at increasing distances from bait station*

BLOCK	NUMBER OF SCATS					GREATEST EXTENT OF COLONY IN FEET	NUMBER RATS FEEDING AT BAIT STATION
	Distance in Feet from Station						
	0-25	25-50	50-75	75-100	100-125		
A	19	2	0	0	0	50	10
B	44	70	17	1	0	150	15
C	37	19	5	4	0	90	15
D	6	9	2	0	0	75	5
E	5	0	0	0	0	10	20
F	16	13	1	0	0	85	30
G	19	8	11	4	0	90	20
H	4	0	1	0	0	65	25
Total feces....	150	121	37	9	0		

Another difficulty in calculating the size of home range of rats is the infrequency of captures. Burt (1940) found that the calculated area of the home range increased with additional captures and then leveled off. Therefore he calculated the size of the home range only for individuals captured frequently enough to show the complete area. In the studies here reported the rats were not caught frequently (Table 3) and hence this method cannot be used. The conclusions for rats cannot be stated in areal terms, but it can be said that rats live for a long time within a limited area, the overall diameter of which seldom exceeds 100–150 feet.

The distance a rat regularly moves is probably largely dependent upon the relation between suitable harborage and the food supply. If the two are close together the rats travel little; if they are far apart the rats travel much. For instance, in many cases rats were found living under a garage, feeding at a garbage can a few feet away, and apparently seldom wandering farther afield. But under different circumstances, as mentioned under experiment 6, the rats may

travel hundreds of yards to get food. Furthermore, if the food supply is scarce or irregularly present the rats will have to travel farther to find it.

Rats do occasionally shift their home ranges. Obviously if their living places

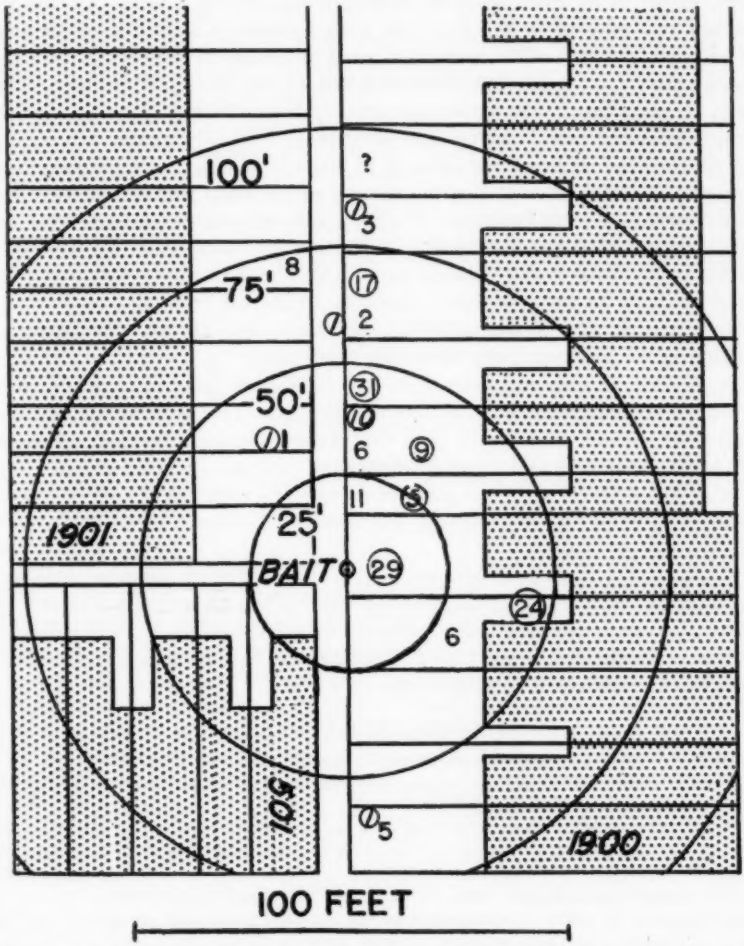

FIG. 6.—Distribution of blue and normal feces. Figures in circles represent blue feces. Figures not encircled represent normal feces.

are destroyed the rats must seek new shelter or if their food supply is removed they must find other sources. On the farm (experiment 5) where conditions were rather uniform rats occasionally shifted from one building to another, presumably

because of some unapparent local change in environment or relations to other rats.

Summary.—In order to determine the home range of brown rats, individuals were captured alive, marked, released, and then recaptured. The experiments were conducted in urban areas in Baltimore and also on a farm. Of 362 rats marked and released in the city, 119 were recaptured after a week or more. Seventy-one per cent of the recaptured adult males and 77 per cent of the recaptured adult females were recaptured within forty feet of original capture. On a farm, during a year, 1830 native rats (1112 individuals) were released. Of 206 recaptured adult males, 75.3 per cent were recaptured within forty feet of original capture and 11.6 per cent moved to another building. Of 167 recaptured young males, 82.6 per cent were recaptured within forty feet and 10.0 per cent were caught in another building. Of 236 recaptured adult females, 84.0 per cent were recaptured within forty feet and 10.0 per cent were found in a different building. Of 219 recaptured young females, 88.0 per cent were recaptured within forty feet and 4.8 per cent were caught in a different building.

Studies of the rate of increase of colonies of rats indicate that immigration is a minor factor in repopulation of an area.

Surveys of rat signs in blocks show that colonies of rats live in definite areas of seldom more than one hundred feet in diameter. Tracks of individual rats in fresh snow seldom extend more than that distance in any direction. Although rats cross alleys, they seldom cross streets.

By using a dye in corn it is possible to color the rat's feces. Surveys of the distribution of colored feces around a bait station indicate a range of about one hundred feet in diameter.

Because rats travel along narrow runways it is difficult to measure the area of home range. These studies indicate that rats seldom travel more than 100–150 feet. The extent of movement is probably largely dependent upon the distribution of food and harborage. Radical changes in the environment may cause extensive movements of individual rats.

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A TECHNIQUE FOR THE AUTOMATIC COLOR MARKING OF SHREWS

BY W. B. QUAY

Much work has been done in recent years on methods of marking mammals in the wild, so that their home ranges, territorial behavior, population densities, dispersal, homing instinct, and natural longevity can be accurately determined. Various systems of marking have been devised, involving such methods as: color banding (Evans and Holdenreid, 1943; Fitzwater, 1943), ringing (Chitty, 1937), tagging (Ashbrook, 1936; Errington and Errington, 1937; MacLulich, 1937; Southern, 1940; Trippensee, 1941; Cook, 1943), depilation (Chitty and Shorten, 1946), branding (Bradt, 1938), tattooing, ear notching, and toe clipping (Ashbrook, *op. cit.*; Aldous, 1940; Burt, 1940; Stickel, 1946a and b). For all the methods of marking so far employed, live-trapping of the animals has been necessary. By live-trapping and marking various mammals, many interesting facts have been revealed. Unfortunately, however, the live-trapping system, as employed in the past, has not been practical for the obtaining of shrews for population study purposes (Burt, *op. cit.*). Shrews captured in live-traps often die of exposure or starvation. The tending of live-traps every few hours might lessen shrew mortality, but in many cases a shrew can stand confinement for only a very limited period of time, after which it dies. To remedy this situation the writer has tried to work out a new technique, so that the live-trapping of shrews that are desired to be marked for study is not necessary. This technique involves the use of snap-back mouse traps, redesigned so that they automatically mark with paint the animals passing through them. The

purpose of this paper is to present and explain this technique, and to demonstrate its effectiveness and its possibilities in the study of shrew populations.

Acknowledgments are made to Mr. B. P. Bole, Jr., who suggested this project and encouraged its publication, to Dr. Arthur B. Williams, who gave permission for this work to be carried out in the North Chagrin Reservation, and to Dr. Harold S. Booth, who made several valuable suggestions, and especially for proposing the use of luminescent pigments for marking.

Methods.—The trap used in this work is the snap-back mouse trap commonly used for the trapping of small mammals. This trap was redesigned in such a way that it would be a practical mammal marking device (Fig. 1). Two holes are drilled about one-half inch apart parallel to and about three-fourths inch from the back end of the trap. These two holes should be slightly to one side of the long median axis of the trap. Through these holes is mounted a loop of wire, twisted on the upper side to form a circular holder for a medicine dropper. On the under side the two wire ends are twisted tightly together and bent back, thus holding the medicine dropper holder on the upper side rigidly. On the opposite side from the medicine dropper and holder, another wire loop is mounted. This is a restraining loop, to keep the arm of the trap from springing beyond the medicine dropper. In order that this loop work effectively, the rectangular arm of the trap should be bent inward slightly so that it can spring the full height of the restraining loop without resistance. The loop should be just high enough to allow the arm of the trap to completely squeeze the bulb of the dropper when the trap is sprung. The medicine dropper should be about two and three-fourths inches long, including glass tube and rubber bulb. Most medicine droppers are about four inches long; these can be used after cutting off the terminal inch and one-fourth of the glass tube. When the dropper is placed in the holder it should be pointed slightly downward so that its contents settle in the forward portion of the tube. It should be aimed in the same vertical plane as the trigger of the trap and pointed approximately one-fourth inch above it for best results.

With other methods of mammal marking each animal was given an individual identifying number or mark. In the technique presented here, instead of each animal being differently marked or numbered, each trap is numbered and has its own characteristic mark. Thus when a series of such traps are set in a colony of shrews, the individual shrews will be marked according to which traps they pass through in their travels.

To find a suitable medium for marking, some testing and experimenting was necessary. The first thing tried was one of the all purpose dyes (Rit) used to tint and dye various fabrics. These colors were not effective; they slightly tinted the fur, but not enough to be noticeable after a small amount of wear. Showcard colors were water soluble and were unsuitable for that reason. Oil paints were first tested on the fur of dried *Blarina* skins. Only about twenty different colors could be easily differentiated on the shrew's fur. An area ninety feet square, designated as Test-Marking Quadrat No. 1, was then chosen for testing the automatic marking of shrews with oil paints. The quadrat is in the North Chagrin Reservation, at which all experimental trapping connected with

this project was done; it is part of the Metropolitan Park System of Cleveland, and is situated in the northeastern corner of Cuyahoga County, Ohio. Automatic marking traps were set in a checker-board pattern at thirty-foot intervals; there being sixteen traps in all. The droppers attached to these traps were filled with oil paint, each trap contained a different color. The traps, all set across runways through the humus of the forest floor, were baited with rolled oats, and were covered with roof-like tarpaper shelters to protect them from rain and falling twigs. Positions of traps and their respective colors were noted on a rough diagram of the quadrat. The automatic marking traps were in operation for three days; every day they were inspected; sprung traps were reset and those with dried paint were refilled. At the end of the third day the automatic marking traps were replaced by regular snap-back traps. During the first trap-night the snap-back traps captured one *Parascalops breweri* and six *Blarina brevicauda*, two of which had paint marks on their fur. One of these had been marked

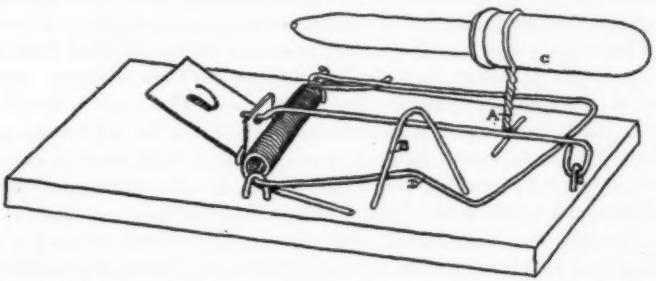

FIG. 1—Automatic small mammal marking trap. A, medicine dropper holder; B, restraining loop; C, bulb of medicine dropper; D, inward bend in the arm of the trap.

twice, with brown and with dark blue; the other had been marked once with red paint. During the following two trap-nights no more marked animals were taken, but the two that had been previously caught were sufficient to show that the automatic marking traps did work and that oil paints could be used for marking short-tailed shrews.

Since twenty was the greatest possible number of oil colors that could be easily differentiated on a shrew's fur, only a small area could be covered by the traps, an area probably not large enough to include the entire home range of any of its resident mammals. Therefore, it was desirable to have a greater number of colors or recognizable marks. Either a new medium was desired or one that could be combined with oil pigments to provide a greater number of different marks. The possibility of using luminescent pigments in conjunction with oil pigments was then brought to the writer's notice. Luminescent pigments are synthetic inorganic chemicals, having the property of emitting visible light after having absorbed radiant energy of a shorter wave length. There are two types of these pigments. Fluorescent pigments emit light when continuously exposed to a uniform source of radiant energy of the proper wave length. "Black"

light, the usual source of this radiant energy, is that portion of ultraviolet light (specifically 3200A–4000A) nearest the visible part of the spectrum. Phosphorescent pigments glow in the dark after previous exposure to daylight or certain other forms of radiant energy. This phosphorescent afterglow lasts from thirty minutes to twelve hours or more, depending on the pigment, after which it can be repeated again and again by renewed exposure of the pigment to light. Four different fluorescent pigments were obtained in one pound quantities. Fluorescent pigments in powder form can be purchased cheaply from many chemical and paint companies. The pigments used in this work were obtained through the New Jersey Zinc Sales Co. The numeral designations and the fluorescent colors of the pigments purchased are: 2200 White, 2235 Pea Green, 2262 Orange-red, and 2264 Light Blue. Six other fluorescent colors could have been obtained, but four was thought to be an adequate number for the test. A "black" light was purchased to enact the pigments. Often advertised in magazines and journals devoted to geological pursuits, these lights can be bought quite cheaply. Small amounts of each fluorescent pigment obtained were mixed with different oil colors and these were tested on the fur of dried *Blarina* skins. The compound pigments resulting from these mixtures had two colors, one evident in daylight, the other in ultraviolet light. These mixtures had almost the same qualities in regard to fluorescent color as did the fluorescent pigments by themselves. For the testing of these compound pigments in the marking of animals, a plot (Test-Marking Quadrat No. 2) 350 feet square was chosen in a beech-maple forest at the North Chagrin Reservation. At fifty-foot intervals, trap sites were marked in a checker-board pattern, making a total of sixty-four trap sites in eight rows of eight traps each. Sixty-four different compounds were made by using the four fluorescent pigments and sixteen artist's oil colors; a turpentine and linseed oil base was used in the mixed paints. The color of the fluorescent pigments under daylight often slightly influenced the shade or tint of the resultant daylight color of the compound pigments; this limited to some extent the number of daylight colors possible. A loaded trap was then set within ten feet of each trap site. All traps were set across runways in leaf-mold and were baited with rolled oats. Numbered tarpaper shelters, about eight by six inches, were made for all traps. A rough diagram was made of the trap sites and the pigments representing them; their positions on the diagram were given corresponding consecutive numbers. The automatic marking traps were set for ten days, and were inspected daily. Those that were sprung were reloaded with paint. If the paint became too thick to be squirted from the dropper it was replaced. For most traps this had to be done about every two days. Each day the numbers of the traps that had been sprung were noted and if the cause of the traps' being sprung was evident, this was noted also. During each of the third, fourth, fifth, and sixth days that the automatic marking traps were in operation, two rows, sixteen traps in all, were reset each day in fresh runways within ten feet of the trap site markers. In this way each marking trap had a second chance to mark the shrews frequenting the tunnels near the trap site, increasing the possibility of marking all shrews resident within

the quadrat. After the tenth day, the automatic marking traps were replaced by regular snap-back mouse traps, baited with rolled oats and sheltered by the same tarpaper covers. These traps were tended daily for three days; those that were sprung during this period were reset and rebaited. Animals caught in the traps were tagged with the numbers of the respective trap sites. They were then examined carefully under ultraviolet, or "black," light and under daylight for visible paint markings.

Results.—From the plot designated as Test-Marking Quadrat No. 1, it was seen that the automatic marking traps were capable of marking short-tailed shrews and that oil paints could be used; this covered a three-day period. In Test-Marking Quadrat No. 2, twenty-one small mammals were snap-trapped during the first night. Of these, sixteen were short-tailed shrews (*Blarina brevicauda*), four were white-footed mice (*Peromyscus leucopus*), and one was a Brewer's mole (*Parascalops breweri*). All sixteen short-tailed shrews and one white-footed mouse showed compound pigment markings. After the second night of snap-trapping, one house mouse (*Mus musculus*) and nine short-tailed shrews were taken; three of the short-tailed shrews had compound pigment markings. None of the four animals, one white-footed mouse and three short-tailed shrews, trapped during the third night showed any signs of having been marked. During the entire period, one white-footed mouse and nineteen short-tailed shrews were marked. This showed that the marking of the short-tailed shrews in the quadrat was eminently successful and since all the shrews caught the first night and a third of those caught the second night were marked, it is very probable that practically all of the unmarked shrews trapped were individuals that had drifted into the quadrat after the removal of its former residents.

The one marked white-footed mouse had two compound pigments on its fur. Of the nineteen marked shrews, one had four pigment marks, one had three, three had two each, and fourteen had but one pigment mark apiece. Thus, for the nineteen marked shrews there were twenty-seven markings, averaging 1.4 marks per shrew. The number of marked shrews of each category and the fluorescent as well as oil colors of their pigment markings are given in Table 1.

Unfortunately, not all of the twenty-seven shrew markings were entirely successful; in ten of them the oil pigment component was not visible and only the fluorescent color of the marking could be determined. However, in some cases the position or trap site of the markings without visible oil color could be determined by comparing the shade of the fluorescent color of the marking with that of the compound pigments containing the same fluorescent ingredient. There are three possible causes for this loss of oil colors in the compound pigment markings on the shrews; any one or a combination of which might have been responsible. The first and most natural possibility is that the oil pigments were worn off a shrew's fur within a very few days. The second is that some of the pigments were too dark to be seen against the almost black color of a shrew's fur after a few days of wear. In compounding the pigments the daylight color of the fluorescent pigments often influenced the shade or tint of the compound

pigments produced; this limited the number of oil colors which could be easily distinguished. As a result, some of the oil colors used in the compound pigments had to be blacks, browns, or grays. When these compound pigments were applied in full strength to a shrew's fur, experimentally, the oil colors of the pigment could be easily distinguished; but in natural conditions where wear is present, the oil color of these darker pigments might well become practically in-

TABLE 1.—*Color of the compound pigment markings on trapped shrews*

NUMBER MARKS PER SHREW	NUMBER OF SHREWS	COLOR OF COMPOUND PIGMENT MARKS ON SHREWS IN DAYLIGHT	COLOR OF COMPOUND PIGMENT MARKS ON SHREWS IN ULTRAVIOLET LIGHT
1	14	1 dark gray	green
		2 white	blue
		3 pink	orange-red
		4 dark gray	green
		5 ?	green
		6 ?	green
		7 ?	green
		8 ?	blue
		9 brown	green
		10 ?	green
		11 olive	green
		12 light blue	green
		13 olive	green
		14 ?	green
2	3	15 light brown	orange-red
		orange	greenish yellow
		16 light blue	green
		?	green
		17 ?	orange-red
		?	green
3	1	18 light red	orange-red
		purple	
		?	
4	1	19 dark gray ?	bluish white
		orange	yellowish white
		red	white
		reddish orange	orange-red

visible. The third possibility is that in some instances the oil pigment rapidly settled to the bottom of the medicine droppers and when the traps were sprung only the fluorescent pigment component was ejected. This sort of thing should be avoidable by slightly tilting the droppers downward so that if the oil pigment did settle it would do so around the aperture and be ejected when the trap was sprung. The fluorescent pigments were never seen to completely settle out of the mixed compound paints used in this work. It was at first feared that oil or fluorescent pigments might poison the animals, but there was no evidence to show that they had any adverse effects on the marked animals which were trapped.

During the ten days that the automatic marking traps were operating, they were sprung 115 times; about ten of these were known to have been caused by falling dirt, or hail, or by the clogging of the trap with dirt by a mole. Subtracting these, the maximum number of springs possibly caused by small mammals passing through the traps was 105. In all, there were twenty-nine successful markings (28 per cent), assuming that none of the marks were completely lost from wear or other causes.

The sites at which the animals had been painted or snap-trapped were plotted on a rough map. A sketchy idea was thereby obtained of the home ranges of the short-tailed shrews that had been living in the quadrat. A map of the second Test-Marking Quadrat, showing the home ranges of the animals marked, is given in Figure 2. This map does not attempt to portray accurately the home ranges of the individual animals concerned because most of them were recorded from no more than two sites within the quadrat. For an accurate analysis of the home ranges of the shrews living in a particular area, the marking traps within a quadrat should be set much closer together. Twenty to twenty-five feet would probably be the best distance between traps. This map serves to show the possibilities, using this technique, of ascertaining the actual home ranges of shrews. One thing can be accurately determined, however, and that is the short-tailed shrew population. Nineteen marked shrews were trapped within the quadrat; of these, the home ranges of twelve probably extended beyond the limits of the quadrat. If it is assumed, in the twelve border-line ranges, that the collective amount of territory lying outside the quadrat limits equals that lying inside the limits, it might be said that the 350 foot square area of Test-Marking Quadrat No. 2 was equivalent to thirteen complete short-tailed shrew home ranges. From this figure the short-tailed shrew population per acre can be determined as 4.6. This population estimate is probably not representative of all shrew populations in similar habitats in the same region. To obtain an accurate analysis of the *Blarina brevicauda* population per acre in a given habitat, the results of many marking quadrats should be averaged. The primary significance of the above estimate is the demonstration that accurate shrew population estimates are possible by using the marking quadrat technique.

Discussion.—From the foregoing results it can be seen that the automatic marking trap is successful in marking *Blarina brevicauda*. Since the marking traps were set exclusively across the subleaf-mold runways in the forest floor it is natural that *Blarina* was nearly the only kind of animal marked. This was as planned, because it has been shown that population studies of most small mammals can be carried out successfully with the use of live-traps (Dice, 1938; Burt, *op. cit.*; Stickel, *op. cit.*). It should also be possible to study populations of the smaller shrews, *Cryptotis* and *Sorex*, by using the automatic marking trap technique; but undoubtedly this would require yet finer methods than those to be used on *Blarina*. Much of the success in marking shrews by the automatic marking traps depends upon the trapper's skill in catching shrews with snap-back mouse traps. With *Blarina*, trapping is comparatively simple, for these shrews can easily be caught in sets placed across their runways and tunnels.

For two major reasons the live-trapping method of obtaining mammals for marking is better for studying *most* small mammals than the automatic marking method described above. Fairly permanent markings can be given the live-

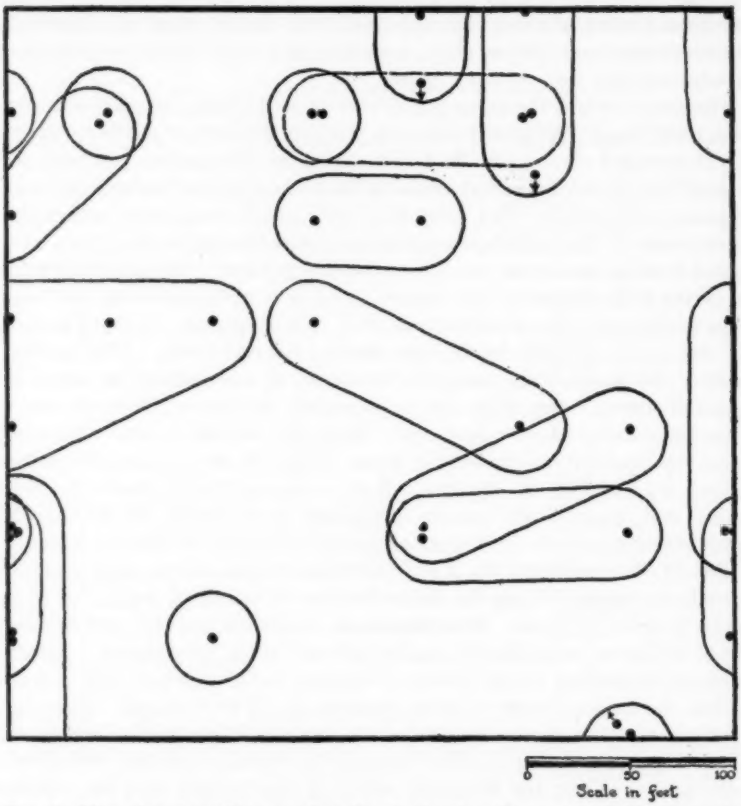

FIG. 2—Map of test-marking quadrat No. 2, showing the ranges of the automatically marked mammals. The solid lines inclose the points at which individual short-tailed shrews were recorded; the broken line, the points at which the white-footed mouse was recorded. The black dots are the approximate points at which the mammals were recorded; those dots with arrows by them stand for records indefinite in location, due to the loss of the oil pigment component of the marks responsible for the records.

trapped animal. The markings that the automatic marking traps are capable of inflicting have only a short duration. It has been shown too that live-traps are often more effective in capturing small mammals than are snap-back traps (Cockrum, 1947), and since the automatic marking traps are but converted snap-back mouse traps, the live-traps probably are more efficient than these also.

Nevertheless, when small mammals can not endure live-trapping methods, the automatic marking technique is the most practicable method.

For accurate shrew population counts, the technique described is well qualified. By preceding quadrat studies, such as those carried out by Bole (1938), with marking quadrats, the resident shrews of a quadrat may be easily separated from those that drift into the plot. Since one of the basic principles in making a small mammal census is for the study to take as short a time as possible, because a mammal's home range is constantly changing (Dice, 1938), the poor durability of the compound pigment markings would not be a factor against the success of using this technique in such a capacity. For best shrew census results using automatic marking traps, the traps should probably be set no more than twenty-five feet apart and should be set for several days. Theoretically, the closer the marking traps are together the less time it should require to mark all resident shrews.

The automatic marking technique has been shown to be applicable to the study of shrew home ranges, but some of the methods used can be improved upon in future studies. For a more satisfactory home range study of *Blarina* or any other shrew the marking traps probably should be no more than twenty-five feet apart. Of course the closer the marking traps are set together the more compound pigments would be necessary so that the marking quadrat would include a large enough territory. Phosphorescent pigments were not tested for marking in this study, but they might be just as effective as the fluorescent pigments. By mixing different fluorescent and phosphorescent pigments together at least eighty different compound pigments could be produced. By adding either some of the brighter oil pigments or some of the different fur dyes, such as those used by Evans and Holdenreid (*op. cit.*) and Fitzwater (*op. cit.*), to fluorescent-phosphorescent compound pigments even a greater number of different compound pigments might be made. These triple compound pigments, if such pigments might be possible, would appear as different colors in the dark, in daylight, and in ultraviolet light. The fur dyes used in marking ground squirrels by Evans and Holdenreid (*op. cit.*) were not tested in automatic marking traps by the writer, but they might prove much more satisfactory for providing a daylight color component to a compound pigment than any of the oil paints. With enough different compound pigments durable for fifteen days or longer, territorial behavior, home range, and other shrew population studies should be possible.

Summary.—Snap-back mouse traps redesigned so that they could automatically mark the animals passing through them with compound pigments were successful in marking short-tailed shrews.

It was discovered that a fabric dye and showcard paints were unsuitable; for very short periods of time, oil pigments were successful; and for periods of ten days and perhaps longer, fluorescent pigments were successfully used in marking shrews.

The automatic marking technique described should be very useful in shrew population counts and studies.

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SURVIVAL OF THE NORTHEASTERN PANTHER (*FELIS CONCOLOR*) IN NEW BRUNSWICK

By Bruce S. Wright

The writer first became interested in reports of the panther in the New Brunswick forests in 1938 when stationed there with the Dominion Forest Service. He soon found that these reports could be traced to the original eyewitness in many cases, and his frequent failure to find discrepancies in their accounts impressed him greatly. In 1938, he began a systematic collection of sight records and track reports, which was interrupted by four years of overseas service, but resumed again upon his return to New Brunswick. Part of the track reports and sight records listed here were obtained from the files of the New Brunswick Game Division, part by correspondence, part by personal interview with the eyewitness concerned, and the last New Brunswick records were made by the writer on March 29, 1947, when photographs (Pls. I and II) were taken. On July 29. 1947, the track casts were made from which the species was positively identified by Mr. Stanley P. Young, Dr. Remington Kellogg, and Dr. H. H. T. Jackson.

Historical references.—The presence of the panther (*Felis concolor* L.) during the early period of settlement in New Brunswick has always been doubtful, although references to it appear in many early works on the fauna of the region. Diereville (1708:140) wrote of "chats et loup cerviers, chat sauvage" which may, or may not, have included the panther. Cooney (1832:232) described an animal which appears to have been part wolf, part wolverine, and part panther, but Gesner (1847:261, 356) was more explicit. He listed "Felis; concolour—congar; catamount—very rare," again he said, "The Felis concolor, panther, painter, or catamount—better known in the Province as the Indian Devil—although a small, is a very dangerous animal: they are very rare, yet sometimes a single skin is brought into the market" at Saint John. In 1884, the Natural History Society of New Brunswick listed in their catalogue of New Brunswick mammals (p. 38): "1. Panther. (Felis concolor.) Dr. Gesner records this species as 'rare' (in 1847). No recent instances of its occurrence are known."

Adams (1873) recorded an incident of a large feline animal attacking and nearly killing a man in the vicinity of Fredericton in 1841. He received this report from Dr. Robb, Professor of Natural History at the University of New Brunswick. Allen (1894, a and b), referring to the Tobique region, said that it "is said to occur but no satisfactory evidence of its present existence in the region was obtained." Boardman (1903:321) listed it as "well authenticated," but Ganong (1903:83) went to considerable pains to contradict two Drs. Thorne who fired at and wounded an animal, in the Caanan region, which they identified as a panther. He concluded: "Summarizing now the entire subject, we are brought to the conclusion that there is not a solitary authentic record, or any other authentic evidence, of either the present or former occurrence of panther within the limits of New Brunswick." The latest publication referring to this species is Squires (1946) who concluded: "Reports concerning the former presence of the cougar or

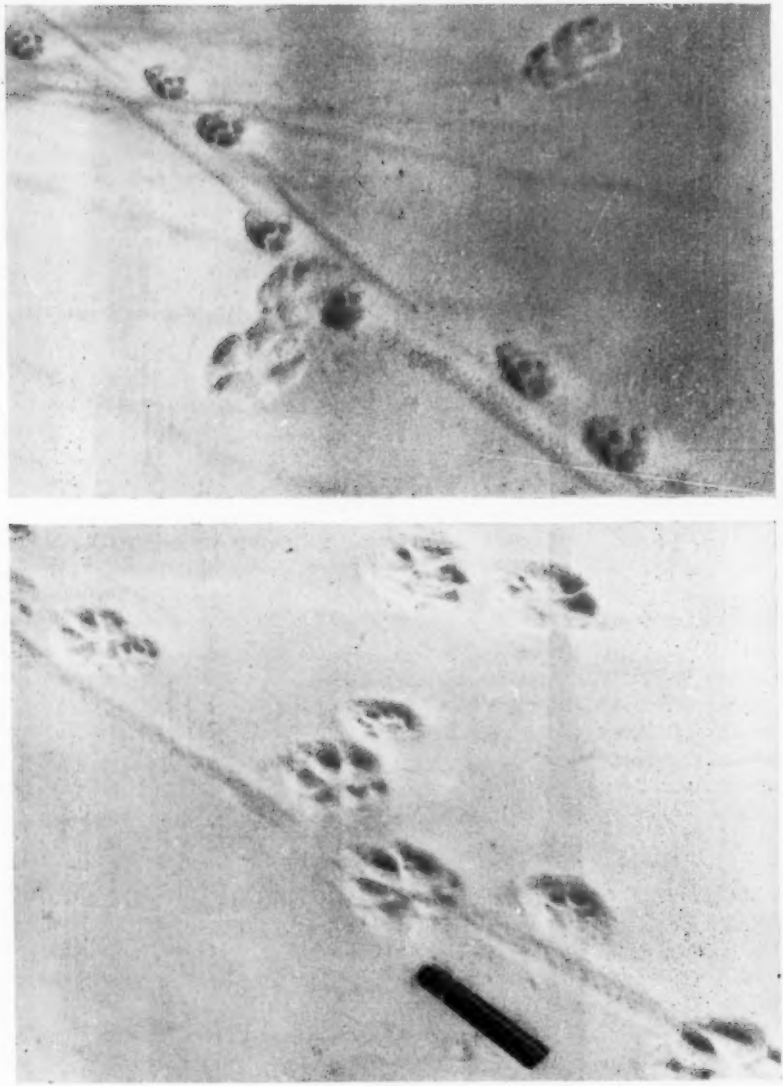

PLATE I

UPPER: A bobcat crossed the old male's trail

LOWER: The female panther and a one-third grown cub joined the male

panther in New Brunswick are so numerous that it would seem very probable that it was found here in the early days of settlement."

This, then, is the history of the species in New Brunswick. I find no historical

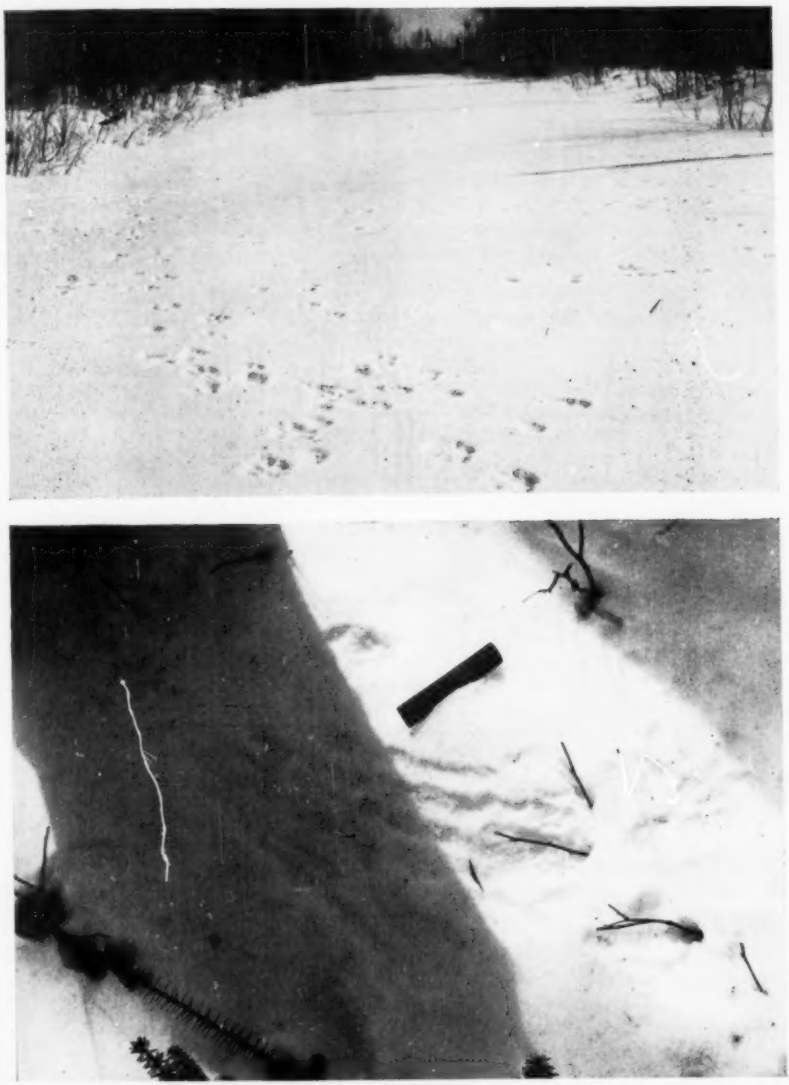

PLATE II

UPPER: The panther family met here. The male came down the road, from the background, on the right; the female and cub came from the bushes at the left

LOWER: Scent post of male on side of log. Note scratching at right near six-inch rule

references to the species in Nova Scotia where it is believed never to have been native. The record cited later in this paper is believed to be the only one in

existence. Quebec records, farthest north for the eastern species, end about 1880. Seton (1929:48) quoted Thomas Anderson of the Hudson's Bay Company to the effect that an Indian hunter shot a panther on South Bay of Lac des Quinze, which is fifteen miles northeast of Lake Timiskaming on the Quebec-Ontario border, in March, 1880. The writer has not seen this record used before, probably because the exact location was not clear. Seton used the old spelling of "Lake Temiscamingue." Seton (1929) listed several sight records from Maine prior to 1907.

The following sight records and track reports have not been previously published. The exact locations and addresses of the eyewitnesses have been witheld in the interest of the surviving remnant. The reports have been grouped by provinces and states and arranged in chronological order.

Recent sight records and track reports from New Brunswick.—1. W. Austin Squires, N. B Museum, Saint John, N. B., reported that a long tailed cat which had been bothering sheep and young cattle was caught in a bear trap by Frank Gibson at Springhill, York County, N. B., about 1900. When in the trap it attacked him and he finally killed it with a fence rail. The skin was used as a mat for many years. Mr. Squires remembers seeing the skin and particularly that the tail was long, at least two feet, and the fur was tan without spots. The skin was finally cut up and used as trimmings on a coat.

2. About 1904, John Gullison, trapper, and David Carey, Game Warden, caught a cub in a trap and saw the track of the mother who circled the trapped cub. The skin was sold for $3.80 to either the Hudson's Bay Company or John Hallam Co., Toronto (they are not sure which), who identified the pelt as that of a "cougar cub." Mr. Carey, still active as a Game Warden, recalls the incident very clearly. He lost the sales slip in a fire a few years ago. As they were not sure of the identity of the animal, they sent the pelt in labelled "Bastard Fox." The skin was called "A cub cougar, or mountain lion" on the company's receipt.

3. In April, 1904, Mr. F. H. McGivney and his father were sugaring about a mile from another camp. They were accustomed to call from camp to camp at night when the sound carried best. One night young McGivney whooped and got an answer from another direction. He continued to call, thinking it was one of the men from the other camp who had lost his way. He was answered each time. He woke his father, and as they waited an animal approached through the trees. He described it as having a heavy shouldered body, three and one-half feet long, and a tail which was not bushy. His father recognized it as a panther. It approached to within two hundred feet of their fire, growled, and leaped from tree to tree in an excited manner. Its cry started with a deep growl and ended in a shrill whooping scream. They were considerably frightened. They had a gun, but did not fire for fear of only wounding the animal. They stayed up all night. The animal remained near for several hours, but finally left just before daylight. (Personal interview)

4. In the autumn of 1919, Mr. Vanderbeck fired several shots at an animal he identified as a panther as it was running across a plowed field. As far as he knew he did not hit it. Later that year he saw tracks of a panther in the same region.

5. Perley W. Vanderbeck, Forest Ranger, reported that two were trapped and one was seen in his area in the winter of 1919–20. There is no record of what became of these specimens.

6. Mr. Edward Pugh related the following experience that he and his brother Ray had in the autumn of 1920. "I had shot a deer and we went out to get it after dark with the aid of a carbide lamp. We had about two miles to go over a hardwood ridge. We first heard a snarl directly ahead and at short range, followed shortly afterwards by a loud yowl. This call was answered from about a mile away by a second animal. The second animal called at intervals as it approached until the two met. They followed us home, one behind and one on the side, and came very close on several occasions. My brother and I were consider

ably frightened although we had rifles, as the animals kept just beyond the range of the light and kept up a continuous loud yelling. They were heard by the remainder of the party in the camp who were worried about us and were greatly relieved when we arrived back. These animals sounded very much louder and stronger than a bobcat or a lynx, with the cries of which I am familiar. We did not get the deer that night." Both of these observers are experienced woodsmen and hunters. Mr. Edward Pugh is a senior member of the New Brunswick Game Division.

7. In August, 1925, Edward Pugh, Dave Willis, and Arthur Briggs saw an animal (panther) at sundown on the side of the road from a car. It ran off with a long loping gait.

8. In the spring of 1926 (?), Mr. William Folsom Merrill had the following experience: "About twenty years ago, on one of my annual spring fishing trips down . . . River, . . . I saw a cougar. . . . I had previously seen one in the far west and had no difficulty in identifying the animal. It was a relatively large one of the species. . . . The animal walked down the bank of the river onto the rocky beach for at least a hundred yards opposite me in plain view. He finally heard me calling to my guide. . . . and just as Vickers was coming to the fly of the tent, the animal sprang from the beach over a high bank at least seven feet high and entered the woods."

9. In August, 1930, Mr. J. C. Veness, Dominion Forest Service, encountered an animal on a portage, standing head on. It appeared to be larger, darker, and heavier than a lynx or bobcat with both of which the observer was familiar. Mr. Veness attempted to take a picture, but the animal bounded into the bush and disappeared.

10. In the summer of 1930, Mr. J. G. Neill saw a panther, at a distance of 200–300 yards, jumping a brook. The long tail was clearly visible. It was seen and heard at intervals all summer by the survey party of which Mr. Neill was a member.

11. In the summer of 1931, Dr. Arthur S. Chesley, Robert Ritchie, and Wetmore Merritt (fishermen), with Ross Mullin, Bert Mullin, and Floyd Matchett (camp crew) had the following experience: "One evening about two hours before dark we were sitting on the verandah . . . when one of us saw an animal swimming across the river just below the forks about one hundred and fifty yards away. It was swimming toward the south bank. The bank, as you probably know, is very steep rising about ten to twelve feet almost in a vertical direction then gradually sloping off to the trees. When this animal reached the shore it stopped thus giving us plenty of time to observe it. It was a cat measuring from rump to snout about five to six feet. The face was long (not flat or chopped off like that of a wild cat). The fur was long and light in colour. I do not recall any striping or spots. It impressed me as being similar to a jaguar or leopard. . . . Matchett brought a rifle, took aim and fired—the bullet struck just above the animal's nose and with one graceful leap it landed on top of this ten or twelve foot rock and ran into the woods. . . . This animal certainly did not impress us as being a wild cat, it was much larger and had a different profile."

12. On September 1, 1934, Mr. W. J. O'Brien, Forest Service Inspector, saw an animal at about fifteen feet. He described it as tawny yellow in color, six feet overall, and about two feet high at the shoulders.

13. In the autumn of 1939, Messrs. William Taylor and J. Gilbert saw an animal they believe to have been a panther cub at a distance of twenty-five feet. It appeared to be thirty to thirty-six inches long, twelve inches across the back, tail twelve to eighteen inches in length and rope-like; very large paws, and light rust brown in colour.

14. In September, 1939, Mr. R. Sweet was walking along a trail when he saw what he thought was a deer. It was the colour of a deer, but when it jumped a windfall he saw it had a body about five feet long with a long tail and he identified it as a panther. It had been watching a flock of partridge. He took a hurried shot and missed.

15. Between 1935 and 1940, Keith Dorcas, Game Warden, saw tracks and followed them to where deer had been chased, but none killed to his knowledge.

16. In August, 1940, Mr. William F. Mullin, guide and trapper, described an animal seen at thirty yards as light brown with gray hairs showing through. Body four feet long, tail two to two and one-half feet long, weight one hundred eighty to two hundred pounds, head very much like a bobcat. It had been seen several times in his district.

17. In August, 1940, Guy H. Hanson described an animal seen within thirty-five feet of his car as brownish or blackish in colour (it was just at dusk), with panther type head, ears, and long tail. It was large ("like a panther") and had a heavy set body. "The minute it laid eyes on our car, it dropped its head down by its front legs, and acted scared and kind of dragged the hinder parts of its body towards the front parts, as though it was going to make itself smaller than it really was. . . . In doing this, the animal put its tail right under the hind legs, and in a sneaking way, sneaked into the bushes and vanished from sight. . . . The best name I can give for this animal is a brown or black panther."

18. In September, 1940, Dr. Alfred Dougan reported seeing a panther when picking blueberries.

19. About 1940, William Haslam, Forest Ranger, reported seeing an animal of the same colour as a deer with a long tail, and higher at the shoulders than a large dog.

20. In November, 1940, Lloyd Wood, trapper, saw the form of a large animal which jumped from a tree and made a loud whooping noise as it disappeared.

21. During the winter of 1940, Alden Geldhart saw a panther about thirty-five feet ahead of him on the road. He described it as having a large head, long tail, brownish in colour, and weighing about one hundred fifty pounds.

22. In the winter of 1940–41, Douglas McGarvey reported a panther hunting the same circuit for the past eighteen months in his district.

23. In February, 1941, Cecil Grieve, mail driver, saw the animal from his car. It was dark gray in colour ("like a bobcat"), had a long tail with a "tuft" at the end, and would weigh between ninety and one hundred pounds.

24. About March 1, 1941, Jack MacLean, teamster, reported meeting a panther sitting in the road while driving his logging team. It was about twenty-five yards from him and showed no fear. It finally walked off the road with a slinking gait that reminded him of "a pacing horse." He estimated its head was about four feet from the ground when sitting down, and when standing up it appeared to be two and one-half feet high and three and one-half feet long, excluding the tail. The tail was long and carried like that of a house cat. The coat was a mixture of yellow-gray and reddish and the length of the hair was such as to make the neck appear to be thicker than the head. The tracks were three to four inches across and were quite common in the district. He further reported that a friend, Fidel Hachey, trailed the panther and found where it had chased a bobcat up a tree, tore it to pieces, and ate it in the tree. He brought pieces of the bobcat, including the tail, back with him to prove his story. These pieces were seen by the writer and the Chief Game Warden of New Brunswick. Hachey has tried to trap the panther without success. (Personal interview)

25. On March 6, 1941, C. N. Tayes, Game Warden, saw where an animal had been trailing a moose. Mr. Tayes described the tracks as two and one-half inches long by three inches wide. This meagre description leaves considerable doubt as to the identity of the tracks, but the observer is familiar with the track of the common bobcat and presumably had reason to make special note of this track. He also reported a similar track sighted in the same region in the winter of 1946–47.

26. On March 15, 1941, Blois Corey, logger, found a deer kill surrounded by cat tracks "the size of a man's hand." The kill had been partly eaten and buried.

27. On March 15, 1941, J. E. Fraser, Forest Ranger, saw tracks four and one-half inches wide and noted that the animal broke through a crust which carried a bobcat. He later identified the panther track pictures in Young and Goldman, and in Seton, as being similar to the ones he saw. He also saw tail drag in the trail. The track was seen again in the winter of 1946–47 and was noted to break through the crust which was almost strong enough to carry a man.

28. On March 20 and 27, 1941, Clarence Johnston and D. D. Pringle found two deer killed within twenty-five yards of each other. They were still warm. The predator had eaten a small portion from each deer. The tracks were three to four inches wide and over four inches long. A large bobcat was later trapped near here, but its feet were much smaller.

29. On April 4, 1941, George W. Lawrence reported sighting a panther; he has seen tracks every spring for the last six or eight years in his district. The animal he saw was about one hundred yards away. It carried its head high and straight out in front giving a very streamlined effect. It was about three feet at the shoulders ("higher than an ordinary police dog").

30. On April 18, 1941, Henry and Earl Matheson saw "the animal described by W. J. O'Brien," (Case 12), and Earl Matheson fired at it, but appeared to miss.

31. In December, 1941, Delbert Hanlon reported tracks of a large cat "large enough to be taken for a moose track from a distance."

32. On February 19, 1943, James A. Campbell, logger, reported very large cat tracks.

33. On March 18, 1943, Ronald Teahan, Game Warden, reported a large cat track and compared it with the track of a Canada lynx which he says was much smaller. He later told the author that when in company with Constable Frank Russell, RCMP, Russell had seen the animal, but he had not.

34. In April, 1943, Steven Beecham, trapper, caught the animal in a heavy double spring trap, but it pulled free. It was apparently caught only by the hide as it left a tuft of reddish hair in the trap. The hair sample was sent to the National Museum of Canada where it could not be matched with red fox, lynx, bobcat, or western cougar, as it had a distinctive reddish hue. This colour was thought to be similar to tufts of hair in limited areas near the axillae and along the flanks to the inguinal region of two skins of the eastern cougar in the Royal Ontario Museum of Zoology (C. H. D. Clarke, letter 2/5/47).

35. On April 18, 1944, H. H. Hoyt, Forest Engineer, Murray McAuley, Jim Charlton, J. E. Fraser, Forest Ranger, and Joe Hickman found the large track in the same area where the writer took the photographs (Pls. I and II), and made a tracing and sent it to the Head Office in Fredericton.

36. In June, 1944, William Blake and his brother reported sighting a panther.

37. On August 13, 1944, Alex Ferguson was walking along a road when the animal appeared about one hundred yards away. It had a long tail which was curved up over its back, and was grayish like a police dog or bobcat.

38. In September, 1944, Douglas McGarvie reported sighting a panther.

39. In November, 1946, Freeman McKnight reported panther tracks in the area where the pictures were later taken.

40. About Christmas time, 1946, and during the winter of 1946–47, William Haslam, Forest Ranger, reported the same large cat tracks he had seen every year for a number of years. Ches Powers and Russell McKinley reported seeing three deer kills last winter which the big cat had fed upon and then covered up.

41. During the winter of 1946–47, A. E. Fraser, Forest Ranger, reported seeing deer kills which had been covered and the large cat tracks around them. One kill was moved and recovered after the second meal, presumably because it had been found by the observer.

42. On March 29, 1947, Bruce S. Wright, Freeman McKnight, and Jim Robinson reported as follows: Weather fine, clear, and bright. No wind. A light fall of fresh snow stopped about 5:00 A. M. Crust heavy enough to carry a two hundred pound man. Fresh sign found about noon, therefore less than seven hours old, and no drift. First found the trail of the adult male trotting up an unused road. This trail was followed from the point where it came out onto the road from a black spruce swamp for about one-half mile, where the scent post and scratch were found denoting the male (Pl. II, Lower). About two hundred yards past the scent post the male joined a female and cub about one-third grown (Pl. I, Lower). This behavior is shown in the photographs. The right forepaw of the adult male measured four and one-half inches wide and five inches long. Trotting stride eighteen inches.

43. On July 29, 1947, Dr. Paul F. Elson, Fisheries Research Board of Canada; Dr. G. F. M. Smith, Professor of Zoology, the University of New Brunswick; Mr. Ward Coates; and the writer made plaster casts of panther tracks in the same region where the photographs were taken. Three reasonably good forepaw prints and three hindpaw prints were found although the tracks were estimated to be five or six days old, and the trail was much used

by moose and deer who had almost obliterated the sign. The casts were positively identified as panther by Mr. Stanley P. Young, Dr. H. H. T. Jackson, and Dr. Remington Kellogg.

These forty-three sight records and track reports bring up to date the New Brunswick data. In 1940, Mr. Kilgore Smith was put on the trail of a panther by Ranger Fraser. He trailed the animal for one week without catching sight of it. The scream, or call, of the panther was heard by a Mr. Jonah in 1944–45, and again last summer. It was reported to the writer as being "halfway between a woman being murdered and a baby crying."

Recent Maine sight records.—1. In May, 1897, Alfred Anderson had the following experience: A horse had died during the winter at a lumber camp where Mr. Anderson was staying as a member of a drive crew. The panther had been feeding on the carcass for some time and was well known to the men at the camp. Mr. Anderson did not believe them so they offered to show him. They took him to the carcass and he saw the animal at a distance of forty yards. He described it to the writer as similar to a leopard, which he had seen in a circus, but dark tawny on top and lighter beneath. When asked if he was familiar with a lynx he replied that he was, and that this animal was four times the size of a lynx. It had a very small waist ("like a greyhound"), but a heavy chest. He thought that this was caused by the fact that it was nearly starving after a hard winter and living on carrion. When it saw him it jumped into dense cover, clearing the ground by six feet in its bound. (Personal interview)

2. In October, 1915, F. G. Farrell, Forest Engineer, then a boy of about fifteen, in company with some other boys, saw the panther in the woods. Farrell, who had a shotgun, fired at it. It bounded into the woods and disappeared. Previous to this encounter several deer hunters, including some of Farrell's relatives, had heard loud cat screams and found deer kills which were quite fresh. At first it was considered to be the work of bobcats, but later some of the older men agreed that it was an "Indian Devil." Some days later the body of the cat Farrell had shot was found. It was already badly decomposed so that there was no possibility of saving the hide and no one thought of the skull. With the body to examine and compare with the pictures in an illustrated natural history book, the animal was identified as a panther, the long tail being unmistakable. (Personal interview and letters)

3. On June 1, 1920, Earl D. Harriman, guide, saw a panther swimming a stream. "He came out on a log . . . wasn't frightened of me at all. I got a very good view of him. His body was about four feet long with a long bushy tail . . . height of shoulders two feet . . . length of hair two inches, colour of head khaki or tan mixture, size of track about the size of a large man's hand. . . . Here they feed on snow shoe rabbits and deer."

These data are all the recent records available for Maine.

A Nova Scotia record.—The following report was contributed by Robie W. Tufts, Dominion Wildlife Officer, Maritime Provinces.

In June, 1923, Mrs. L. H. Bishop saw the animal five times. It was seen four times in the morning and once in the evening when it chased home their collie dog. It appeared to be making no particular effort to catch the dog, but loped along behind it with the dog running at full speed for the house. It was first seen at daylight at about one hundred yards "slinking" along the road. Another time it was seen in the clearing behind the house looking down at the buildings, and again it was seen "loping" along the edge of the woods. Mrs. Bishop remembers the "extreme gracefulness" of the animal when it moved, and that "it had a long tail that had a curve in it, and was not bushy like a fox's." In colour it was "a dirty yellowish gray." Prior to actually seeing the animal, she and others had heard a long drawn out call of an ascending note, which she described as "blood-curdling." The call was usually heard after dark and was kept up intermittently for some time.

The year 1923 was a very bad fire year in New Brunswick. Mrs. Bishop recalls that the whole horizon was dull with smoke and there was an influx of deer in the part of Nova Scotia next to the New Brunswick border "which seemed sort of dazed." She thought that the "strange beast" also came from New Brunswick as it was not seen again in that locality, much to her relief. The large fires in New Brunswick that year were all in the northern part

of the province, but the heavy smoke may have moved the deer, as the observer reported, even as far south as the Nova Scotia boundary. Her deductions as to the cause of the sudden appearance of a panther where they have never before been reported are therefore reasonable.

Miscellaneous eastern records.—In February, 1947, the writer met a man, whose name escaped him before he had a chance to write it down, in Montpelier, Vermont, who told of seeing a panther in the headlights of his car in 1941 or 1942. He and his wife and his wife's sister were in the car and they stopped to let the panther cross the road. It was in sight for several minutes.

The August 1945 issue of "Outdoor Life," in the column titled "All Over the Map" by P. A. Parsons, has the following item: "Oddities: Farmers in Cape Fear County, N. C., have been losing dogs and pigs. Casts of footprints of two animals identified by Harry Davis, curator of the State Museum, as those of a male and female panther, believed to be the cause of disappearance. First such animals known to be in the state since 1900." This record may however refer to *F. c. coryi* as Cape Fear County is just about on the boundary between *coryi* and *couguar* as given by Young and Goldman (1946).

Status of the species in New Brunswick.—The data have been deliberately vague as regards locale to save the species from unscrupulous trophy hunters, but when plotted on a map they show distinct groupings in three major areas. Both summer and winter records are found in each of these areas so that they do not represent seasonal changes in range by a single animal or family. One of these areas is very large and is bisected by a main river so that it is quite possible that there are two populations there instead of one. Until further information is available, however, this area will be treated as one population unit.

As the data covers a span of years in each area which is greater than the life span of a single animal, it is permissible to assume that each of these population units consists of at least one breeding pair. The photographs clearly show that one pair was accompanied by a one-third grown cub in March, 1947, which establishes beyond question that the species is a local breeder. The panther has never been common in New Brunswick and is listed at best as very rare in all the earlier works. Sir Charles G. D. Roberts' fiction of the New Brunswick forests contains references to the species in almost every volume, but as the works were fiction, he was not taken seriously. From this we may deduce that there has always been a few pair of panther breeding in New Brunswick, and as the northeastern states became more and more settled, the survivors in this region were pushed farther and farther to the northeast into the sparsely settled areas of northern Maine and New Brunswick, where they have survived relatively unmolested to this day. This region is rich in deer, the principal food species, and as there are very few if any dogs trained to trail cats in the region, they have been immune from organized hunting and have only been seen by accident. A few accidental encounters with traps and the occasional shot fired at them by a surprised traveler is all the hunting pressure they have had to contend with.

Regarding the possibility that the panther is a newcomer to New Brunswick, which followed the deer into the province with the upswing of the deer herd after the logging of the original forest, there are two writers who have made pertinent comments. Roberts (1896:324) said, "These animals . . . were growing yearly more numerous in the Squatook regions, owing to the fact that the cariboo, their

favourite prey, were being driven hither from the south counties and from Nova Scotia." Squires (1946), speaking of the commonly believed statement that deer were unknown in New Brunswick prior to about 1818, said, "There seems to be plenty of reason to doubt the statement that the deer was a newcomer. Lescarbot (1610), referring to the Indians of Acadia in general, wrote that in winter they went inland where they could catch beavers and other game such as elk, caribou and deer (Ellans, Caribous, Cerfs); he also told (1612) about an Indian killing a deer (Cerf) at Port Royal across the Bay of Fundy from New Brunswick. Le Clerq (1691) reported deer as well as caribou and moose as occurring in his mission territory which extended from eastern Gaspe to Miramichi. He spent most of his time at Restigouche so that this report placed the deer in or near northeastern New Brunswick at an early date. Raymond (1905) noted eighty-five deer skins mentioned among the furs and skins shipped from Saint John by Simonds and White during 1764–1774."

It would seem, therefore, that the deer have always been native to the province, but have suffered several severe fluctuations in numbers. This evidence, together with Roberts' statement that the panther preyed on caribou (which is substantiated by Seton's Lac des Quinze record from Quebec in which the hunter found 'a place where it had killed a caribou'), suggests that the panther has always been indigenous to New Brunswick. The population seems therefore to be in a state of equilibrium with its environment, as it has survived until this late date without any noticeable change in numbers.

The panther–man relationship.—The panther, as any other large carnivore, can and sometimes will kill domestic stock, but it is significant that in the period of about fifty years covered by these records there is no mention of this having taken place. This is evidence that the supply of natural wild food is adequate for the needs of the few surviving panthers in the Province, and this condition may be expected to continue as the species is a very slow breeder and even in the early days was never present in large numbers.

On several occasions panthers are reported to have answered a man calling in the woods at night and have come to him. This has occurred both in the spring and in the fall. It is probable that these animals were seeking mates as there is no fixed breeding season.

There is one early record of a nearly fatal attack on a man near Fredericton (Adams, 1873) by "a large feline animal" which was probably a panther, but numerous more recent encounters at very short range do not indicate a dangerous disposition. This is in accordance with the behavior of the species in all parts of its range. In the overwhelming majority of cases, the animal lost no time in getting out of sight as soon as it saw its observer. On several occasions however it has shown a lack of fear of man and has deliberately remained in sight for some time. These may be young animals who have not yet learned to fear man. One old male (the one whose tracks are shown in Plate I, Upper) has been reported in the same heavily logged region for fourteen years, but there is not one sight record of the animal to be found in the area. This shows how well he has adapted himself to living in close proximity to man without interfering with him in any way.

He has not only lived there for fourteen years unseen, but this year he has raised a family, still unseen.

All the data, therefore, indicate that the relation of the panther to man in this region is a completely innocuous one, and that there is no cause for alarm in the announcement that one of the noblest predators of the continent may still be met with in the spruce forests of the northeast.

Taxonomic position.—Regarding the taxonomic position of the New Brunswick panther, Mr. Stanley P. Young has this to say (letter, 4/30/47), "Whether or not you have the race *F. c. couguar* up there would be a moot question. You may have a new race of puma. At the time the late Major Goldman and myself completed the revision of the puma, specimens of this eastern form were exceedingly scarce, and of course still are. . . . We felt that could we have worked on the revision in earlier times when more specimens were available (by taking in the wilds) it is quite probable that the present range designated for *F. c. couguar* would have been cut down in size by another form."

There remains one point, however, upon which a definition would seem to be in order at this time. That is the matter of the common name of the species. Puma, cougar, mountain lion, are all western terms, whereas in the east the animal was known as the panther from the time of its discovery by white men until the time of its supposed extinction about the end of the last century. For this reason, coupled with the fact that the northeastern population is almost certainly a different race from the western and southern populations, the writer suggests that the common name of panther should be continued to distinguish the northeastern variety from the more common forms in other regions.

A management plan.—In formulating a management plan for this last remnant of a species which has long been considered to be extinct, the following points should be considered:

1. The present population in New Brunswick, with a possible overflow into Maine, is the last remnant left on earth of either *Felis concolor couguar* Kerr, or a closely related new subspecies.

2. The species has never been common enough to constitute a threat to domestic livestock, or to seriously deplete wild game, and therefore has no adverse effect upon the human population of the region.

3. The effect of the presence in limited numbers of this natural predator upon the deer herd has been proved in many areas to be decidedly beneficial to the well-being of the herd. The New Brunswick Government has paid out an average of over twenty-two thousand dollars per year in porcupine bounties during the last three years. The porcupine comprises about twenty per cent by volume of the food of the western mountain lion (Young and Goldman 1946: 128), and if future studies bring out that this habit is common to the eastern species as well, it may be shown to be a valuable check on the porcupine population.

4. The recent paper of Leopold, Sowls, and Spencer (1947) points out that there are about one hundred known deer herds in the United States and Canada which are in one or the other stages of irruption. The possibility of disposing of

unwanted breeding stock in these areas having a deer problem is not to be ignored. Although this re-introduction of predators may seem too drastic a management technique for some of the more settled areas, there would appear to be definite possibilities in it for wilderness areas. However, there is no immediate prospect of a surplus breeding stock in New Brunswick, and if and when such a situation does arise our deer management thinking may be sufficiently advanced to make use of it to restock over-populated deer ranges in the northeast with their natural predator.

Management of the species, therefore, should take the form of absolute protection of this last remnant at this time. It is time enough to think of collecting specimens to settle taxonomic and other questions when the panther is a much more common animal than it is today. Accumulation of data on the species aimed at a study of panther ecology in the northeast is already underway at this station.

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THE STATUS OF MAMMALS IN THE U. S. NATIONAL PARK SYSTEM, 1947

By Victor H. Cahalane

More than sixty thousand hoofed mammals find refuge within the National Park System (Fig. 1). Many thousands of carnivores and millions of rodents inhabit the 172 areas. Some of the species are highly spectacular. Some are rare and apparently vanishing from the remainder of their ranges where they are still subject to hunting and trapping. Most of the park areas are too small to protect adequate numbers of the species that are widely ranging. Even in most of the largest parks, wildlife is influenced by hunting and trapping or by agricultural or other practices on exterior lands. These adverse effects seem to have been intensified during the past five years, when field staffs were greatly reduced and economic conditions resulted in increased pressure on natural resources. It seems advisable therefore to examine the condition of the more important mammals that inhabit the larger parks and monuments and to try to forecast the chances for survival of the rarer and less favorably situated species.

Due to the war and other factors, information on the fauna of a number of important parks is deficient. The field staffs, however, have made such studies as were possible. This paper is largely a digest of reports which have been compiled by rangers, naturalists, and administrative officers, often under difficulty. Their interest and help are gratefully acknowledged.

CHIROPTERA

The animal which excites the greatest popular interest at Carlsbad Caverns National Park is of course the bat. The predominant species is the Mexican free-tailed bat (*Tadarida mexicana*). From a high in 1942, the population of the colony dropped to a minimum in 1946. It now seems to be increasing. Drought probably was the cause of this wide fluctuation through its influence on the insect food supply.

CARNIVORA

Euarctos americanus. Black bear.—Black bears are increasing in the "back country" of Yosemite and the total number in the park is estimated at 250. In other parks, the populations have remained stable or have decreased. Considerably fewer bears have been seen this summer at Crater Lake and in Mesa Verde and Rocky Mountain national parks. This reduction seems to be general throughout Colorado; the reason is unknown. At Crater Lake, it is thought that scarcity of garbage and other artificial food during the war years resulted in the dispersal of one-half to two-thirds of the estimated sixty-five bears. A return to the normal balance between bears and the carrying capacity of the park is much to be desired. No information is available concerning the population trend in Glacier Bay Monument. Black bears are rather numerous in the forests of the southern part of the area. The "glacier" bear, which is a blue-gray color phase of the black, is rare.

In the smaller parks and those of the Southwest, black bears are relatively scarce. Because they range widely at times and because they are generally outlawed on stock ranges, these animals lead a precarious existence. Thus a number of parks such as Lassen, Zion, Grand Canyon, and Shenandoah, as well as most national monuments, are inadequate as refuges for this species. The dispersal of bears from the Great Smokies causes special concern. A large population, estimated at 300 animals, lives on a wilderness "island" surrounded by intensively farmed country. Particularly when berry or nut crops fail, bears leave the park and attack poultry, swine, cattle, or other domestic stock. Many of these predators are destroyed; other bears are killed on suspicion. The toll that has been levied in recent years against the park bear population of the Great Smokies may exceed the birth rate.

The problem of park visitor-black bear relationships has improved noticeably in the Sierran parks where the official "bear shows" were discontinued seven to ten years ago. (The last one was in Yellowstone Park; it was terminated in 1941.) At Great Smokies, Yellowstone, and Glacier, further improvement is necessary. The public is being informed bluntly that bears are potentially dangerous and must not be treated as domesticated pets. Most visitors govern themselves accordingly. The reckless minority may be impressed only by the exaction of fines or jail sentences. The problem is sufficiently serious. In the sixteen years prior to 1947, at least 711 persons were injured by bears in Yellowstone Park. In the same period, 471 troublesome or dangerous bears were destroyed. This was only ten per cent less than the probable number of births, and reserved insufficient margin for natural losses and for inevitable drainage by hunting around the boundaries of the park.

FIG. 1.—National Parks and other areas mentioned in text

In the most recently established parks, Big Bend and Everglades, black bears were almost eliminated by hunting before the areas could be made effective sanctuaries. Until recently, no bears or evidences of their presence in Big Bend had been seen for three years. Two reports made during the past several months may be records of animals that range across the Rio Grande from the Carmen-Fronteriza area in Mexico. In the Florida Everglades the species is desperately low. It may be necessary to stock a number of bears of the proper race if a normal population is to be restored.

Ursus. Grizzly bear.—Almost one-third of the surviving grizzlies in the United States live in Yellowstone and Glacier national parks. These numbers are estimated at three hundred and one hundred, respectively. Grand Teton Park may contain a few additional animals, but the area is too small and much of it is too barren to provide adequate refuge for this species. In fact, only two grizzlies have been seen in Teton during the past ten years. Within Yellowstone and Glacier, grizzlies seem to have varied little in number over the past couple of decades. It should be understood, however, that the populations of this animal can only be estimated and that the estimates may be too high. In addition to deaths from natural causes, such as fighting, winter-kill, and disease, grizzlies are hunted rather intensively in the regions surrounding both parks.

Occasionally, individuals are destroyed within the parks when they become chronically destructive to property or hazardous to human life. This sacrifice of bears in the interest of human safety usually is not detrimental to the species and generally is justifiable. However, in 1942 *thirty* grizzlies were shot within Yellowstone Park. Such heavy losses could not be sustained for long. All precautions are being taken to reduce them to a minimum. The Park Service is now attempting to work out means of fencing a major living area in Yellowstone. If successful, this should provide visitors with a safe, bear-free camping spot and also save a number of bears (grizzlies and blacks) from untimely death. This measure, with others such as abolition of the Canyon "bear show," should make it unnecessary to ever again destroy significant numbers of these interesting animals.

The future of the grizzlies and big brown bears in the park areas in Alaska is more secure, provided the areas themselves can be held intact. Extensive bear habitat is protected in Katmai and Glacier Bay national monuments, where the animals are numerous and appear to be thriving. In McKinley Park bears are confined by ice fields to a relatively narrow strip of tundra and barren mountains. If hunting is intensified north of the park, its bear population may be much reduced.

Nasua narica. Coati.—That extremely rare animal in the United States, the coati, during recent years, has become more abundant in Organ Pipe Cactus National Monument, as it has elsewhere in southern Arizona. It is thought to be more plentiful than the few sight records indicate.

Martes. Marten and Fisher.—Among the rarer furbearers, marten seem to be in most satisfactory condition. It is reported as increasing in the Sequoia-Kings Canyon area. Fishers are present in Sequoia, Kings Canyon, Yosemite, and probably Glacier national parks, but are rare. A dependable report of a fisher came in June, 1947, from a locality close to the boundary of Olympic Park. The species was previously thought to be extinct in the region. Aside from normal rarity, the only possible explanation for the continued scarcity of fishers in the United States parks is legal trapping around the boundaries, and perhaps poaching.

Gulo luscus. Wolverine.—The status of wolverines is similar or even less favorable than that of the fisher. With the exception of McKinley Park, where they are widely distributed and apparently in normal numbers, wolverines are exceedingly scarce in the few United States parks where they still persist. The species has been seen with fair regularity in Sequoia Park, but the last unquestionable record for Yosemite was made in 1932. At Grand Teton, the wolverine has been reported only twice in the past ten years. The brief appearance of a single animal near the South Entrance in 1946 is the only acceptable record for Yellowstone Park in many years. Tracks are sometimes seen in the snow in Glacier Park. The future of the wolverine in our western parks is precarious to say the least.

Lutra canadensis. Otter.—The otter is distributed more widely and is somewhat more numerous. It is relatively abundant in the Everglades, but is termed "uncommon" (between "rare" and "common") in Mount McKinley, Glacier, Mount Rainier, Olympic, Yellowstone, and Yosemite national parks. It occurs "rarely" at Grand Teton, Grand Canyon, and Acadia. The trend of the otter population is unknown except in Grand Teton. Although once fairly common there, the species has become scarce in recent years. The probable cause is trapping. Settlement of the Jackson Hole Monument dispute and addition of the entire area to the protected park will be a boon to the otter.

Taxidea taxus. Badger.—The badger is found in suitable habitats on many park areas from Glacier and Theodore Roosevelt parks to Organ Pipe Cactus National Monument. Special comment need be made of only one occurrence. In 1940, after many years' absence, the badger was restored to Wind Cave Park in southwestern South Dakota. A pair of semitame animals was released in the area with the double objective of returning a once native species and of initiating natural control of prairie dogs which were thought by some officials to be increasing unduly. It is known that one litter of young was produced, but apparently all of the badgers subsequently left the park. No evidence of their presence has been found for two years.

Urocyon cinereoargenteus. Gray fox.—The red fox and gray fox are widespread and generally numerous. The gray fox is reported to be much less abundant than formerly at

Saguaro National Monument. In Big Bend, due to elimination of trapping and poisoning, it is increasing rapidly. Rabies has become epidemic among the gray foxes in Organ Pipe Cactus National Monument. A number of cases of this disease have also been reported durint the past six or seven years in park and monument areas in the southeastern states.

Vulpes. Kit fox.—Kit foxes are comparatively abundant in Big Bend Park, Death Valley, and Organ Pipe Cactus monuments, and in the Lake Mead Recreational Area. They are often seen on roads and in campgrounds in Death Valley and are among the most notable wildlife attractions of this national monument. These foxes are increasing in Big Bend, but at Organ Pipe the rabies infection probably will cause a diminution in numbers.

Canis latrans. Coyote.—What about coyotes? They have continued in about the same numbers in most of the parks and monuments. Scarcity of rodents seems to have led to decline in these predators at Mesa Verde, Petrified Forest, and Saguaro. A marked decrease has been noted also in Lava Beds National Monument. Poisoning and trapping in the region surrounding Organ Pipe Cactus Monument has drained off a noticeable percentage of the coyote population on the protected area. This control program is to be intensified in an attempt to stop the spread of rabies. A similar reduction of coyotes, this time to the point of scarcity, is reported from Dinosaur National Monument on the Utah–Colorado border. An over-population of mule deer in this area makes an increase of predators desirable. Coyotes have become much more abundant recently in Rocky Mountain and Zion national parks. Both of these areas have serious deer problems. In Big Bend, coyotes are abundant, but trapping on the surrounding range prevents further increase. In fact, the Superintendent reports that after two years of park protection the coyote population is approximately the same as that of ten years ago when the area was used for ranching.

It is surprising to some persons that little change has occurred in coyote numbers in Yellowstone Park since all control of that species ceased twelve years ago. As is well known, the northern portion of the park has been afflicted for decades with serious ungulate problems. Use pressure continues too heavy to permit much recovery of the key forage species. Under these conditions, more predation rather than less is desirable. However, livestock interests north of Yellowstone have insisted that park-reared coyotes contribute in important degree to the losses of sheep, calves, and other animals. In 1945, the Fish and Wildlife Service and National Park Service began an investigation into the migrations of coyotes in this area. More information must be gathered to permit of drawing definite conclusions. Thus far, the data indicates that adult coyotes follow the "game" out of and back into the park, but that pups may disperse on one-way trips to lower elevations. One of these wanderers traveled to a point seventy-two miles by air line from the den where it was tagged in the park.

At Mount McKinley, coyotes occur mainly near the low, north boundary. Because of lack of suitable food, they are rare within the park. None have been reported recently in the sheep hills, where they might be suspected of destroying lambs. Coyotes are said to be present in Katmai National Monument, but information regarding their abundance or scarcity is lacking. Tracks are numerous on the beaches in Glacier Bay, particularly at Sandy Cove.

Canis lupus. Wolf.—The wolf population in the sheep hills of McKinley Park is roughly the same as last year when it was estimated that there were fifteen. This is a radical reduction from the number present during the decade 1932–42; approximately fifty. In order to afford maximum protection for the Dall sheep, control measures are still in effect. Since the order was issued in December, 1945, four wolves have been destroyed.

Wolves were numerous in Katmai Monument in 1940, since which time no authentic reports have been received. They are present also in Glacier Bay, but apparently are not numerous. In the parks within the United States proper, wolves are rare. They are permanent residents only in Glacier National Park in Montana, where numerous tracks have been seen during the past four years. The park staff has estimated the number of animals at fourteen, or almost as many as at McKinley. However, in the adjacent Waterton Lakes National Park in Canada, where they might be expected to wander at times, wolves are said to be scarce.

The first authenticated report of a wolf in Mount Rainier National Park since 1937 was received in April of the present year. A large *Canis* seen at Crater Lake Park in January, 1947, may have been a stray wolf. Three reliable reports of a single wolf (two of which were supported by plaster casts of the tracks) were received from Yellowstone Park in 1941, 1944, and 1946. Presumably the animal (or animals) left the protected area for nothing has been heard of it during the past year. The Florida wolf (*Canis niger*) undoubtedly is extinct in the Everglades.

Felis concolor. Cougar.—The cougar is seen or its tracks are noted at intervals in many park areas throughout the west. In the smaller parks and most of the monuments it is merely a transient. Only the larger sanctuaries afford space and food sufficient for a permanent population–and a small population at that. For example, the Custodian of Dinosaur National Monument states that "a few of these cats–about half a dozen–are left in the Lodore and Yampa Canyon sections. They need protection if they are not to become extinct." At Organ Pipe Cactus Monument, "Probably two or three pairs are resident; all increases move out into the surrounding area where eventually they are eliminated." The park staff at Mount Rainier estimates that "approximately ten cougars include the park as a portion of their range. Some twelve cougars were reported trailed and killed just outside the western park boundary in 1946." In Yosemite, the estimated population is twelve; in Glacier Park, fifteen. The staff of Sequoia–Kings Canyon parks believe that cougars are "uncommon" in their area. This despite a surplus of mule deer and numerous deaths from malnutrition. Cougars are also "uncommon" at Olympic, where an abundance of elk and deer would seem to furnish an easy living for a large number of these powerful cats.

At Grand Canyon, charges that the park was over-populated with lions were investigated in 1946 by the District Agent of the Fish and Wildlife Service's Division of Predator and Rodent Control. In his opinion, the best cougar habitat in the area–the North Rim–contained a "moderate" number of the animals. No evidences of this species in Yellowstone Park were found for many years following the killing of the "last" cougar in 1925. During the past six or seven years, however, a few sight records have been reported.

Evidence on the numbers of cougars is difficult to obtain without special, intensive study. From rather casual or fragmentary observations, however, it is inferred that in most of the western parks the population has not varied greatly over the past decade. Exceptions are Lassen Park and Saguaro Monument, where it has been much reduced. It is possible that the cougar is nearing extinction in the Lassen region. At Mesa Verde, protection and a larger deer population are believed to be responsible for a slow increase of the predators.

In Big Bend, cougars may be slightly more numerous than in 1945 when the park was established and closed to hunting. Very few signs have been observed, however. More than one hundred cougars were destroyed in this area between 1929 and 1942 by only two ranchers; it is probable that they and other hunters had reduced the cat population to the vanishing point before the reservation was established.

Lion hunting has become intensive in the region between Zion and Bryce Canyon parks in southern Utah. There, an industry has grown up and permanent hunting camps have been established adjacent to the park boundaries. Hunter-guides charge sportsmen a fee of five hundred to one thousand dollars an animal. Due to this activity and to control programs, at least fifty-two cougars have been destroyed in this area since 1942. Unfortunately, a severe problem of surplus mule deer also exists here.

In the east, a few cougars or "panthers" are known to have survived in the recently established Everglades Park. At Shenandoah Park, rangers and visitors have reported on several occasions seeing a "long-tailed cat." It is thought that there are two cougars in this area, which lies astride a wilderness section of the Blue Ridge in northern Virginia.

Lynx canadensis. Lynx.—The lynx is a rare species in the parks, as it generally is elsewhere throughout its range in the United States. It still exists in McKinley, Glacier, Yellowstone, and Teton parks. No information is available concerning population trends during recent years. In the early days, the lynx was considered numerous in Yellowstone and the Jackson Hole country, including the present Teton Park. Now it is extremely scarce. At McKinley, perhaps the lynx will become more abundant since the snowshoe hare appears to

be definitely increasing after a long period of scarcity. This cat disappeared from the fauna of Isle Royale National Park long before the area was given protection. Possibly its final extinction is connected with the increase of moose during the 1920's. These huge hoofed mammals had a drastic effect on the vegetation which undoubtedly led to the scarcity of snowshoe hares. Because of the lack of sufficient numbers of this favorite food, as well as of small rodents, any attempt to restore the lynx to Isle Royale under present conditions would be doomed to failure.

Lynx rufus. Bobcat.—Bobcats are found commonly in practically all park areas where there is suitable food and shelter. Shenandoah and Great Smoky Mountains parks in the east contain a relatively large number, but the species has been nearly or quite exterminated from Acadia. West of the Mississippi, bobcats are termed "common" in most of the larger areas. They are "rare" or "uncommon" in Crater Lake, Lassen, Sequoia-Kings Canyon, Zion, and Rocky Mountain. The species apparently has become extinct in the Yellowstone-Teton parks. Our only information on numerical trends comes from Petrified Forest and Saguaro monuments in Arizona, where bobcats are said to be decreasing.

RODENTIA AND LAGOMORPHA

What about the various small rodents that provide food for carnivorous mammals? A few reports are available. The Wyoming ground squirrel (*Citellus richardsonii elegans*) has increased so markedly in the lower meadows of Rocky Mountain National Park that damage to grasses is noticeable. To some extent, the elk-deer problem is thus aggravated. Yosemite reports an influx of California jack rabbits along the western boundary of the park. In Saguaro National Monument, all of the larger rodents are well below their peaks. Only a few rock squirrels are seen, although the species formerly was abundant. Other ground squirrels at Saguaro have decreased to less than half the number present in 1941. At higher elevations in the Monument, western chipmunks show a marked decline. Jack rabbits (*Lepus alleni* and *L. californicus*) were fairly common in 1946, but have been observed only rarely this year. No young of either species were seen this spring. Similar scarcity has been reported from other parts of Arizona, including the Kaibab National Forest. However, cottontails at Saguaro have recovered from the low point of 1940 until they appear to be fully as numerous as ever. Hundreds of immature individuals were seen in April and May.

A sharp reduction in the populations of most rodents in Mesa Verde National Park was first noticed in 1945. Studies by the U. S. Public Health Service in 1946 and 1947 have dispelled the suspicion that plague might be responsible, but have not disclosed the reason for the die-off.

Grand Canyon reports a severe reduction in the numbers of Kaibab squirrels throughout 1945 and 1946. Very few Abert squirrels have been observed recently, compared with prior years. Unfortunately, most of these are found dead on highways, evidently killed by automobiles.

Cynomys. Prairie dog.—Prairie dog "towns" are thriving in Badlands, Scotts Bluff, and Petrified Forest monuments, and Wind Cave Park. Many visitors to Wind Cave find these lively rodents much more interesting than the buffaloes, antelope, and other "big game." One of the two prairie dog colonies in Mesa Verde Park was decimated in 1944–45, apparently by disease.

Castor canadensis. Beaver.—A big rodent that is flourishing is the beaver. In places it is conflicting with man's occupation of the parks or with his conception of the "natural balance." At Rocky Mountain Park, the ponds are a constant object of complaint by concessions operators, and by owners of interior land holdings. A live-trapping program is maintained in order to minimize damage to private property. Beavers have filled all available habitats on Isle Royale and have consumed most of the choicer foods that are readily available. They are in direct competition with the moose for such preferred species as aspen and willow. At Big Bend, beavers have benefitted from park protection and have increased throughout the park segment of the Rio Grande. Some are trapped legally each winter on the Mexican side of the river.

In a rather similar situation, at Mesa Verde, the small beaver colony is increasing in the section of the Mancos River that flows through the park. From colonies established west of Yosemite by the California Fish and Game Commission, beavers have invaded this park in three places. During the early winter of 1944, the species was restored temporarily to Zion National Park when one beaver occupied a bank den and cut cottonwoods on the Virgin River about four miles inside the southern boundary. This animal, the first recorded since 1900, undoubtedly migrated outside the park for it has not been seen since.

Erethizon. Porcupine.—Because of their general distribution and lack of significance, porcupines will be mentioned in only two instances. They are said to be increasing markedly in all parts of Yosemite Park. Around the cliff dwellings at Mesa Verde, difficulty has been experienced for years in protecting aesthetically desirable trees from destruction by porcupines. During the early portion of the present decade, a great majority of the pinyons around Cliff Palace were badly damaged or killed. This resulted in part from a considerable increase in the porcupines. While a definite decline has occurred in the past two years, the porcupines are still regarded by some observers as too abundant for the best interests of the forest. A study of numbers and habits of the rodents is being conducted in cooperation with the Fish and Wildlife Service.

ARTIODACTYLA

Pecari. Peccary.—Peccaries are resident in some numbers in four park areas; they occur intermittently and in small groups in a fifth (Chiricahua Monument). At Big Bend, peccaries are confined chiefly to the foothills north and east of the Chisos Mountains. The population of seventy-five which was estimated in the park in 1946 is increasing rapidly. A herd of about twenty animals was seen early in July 1947. At Saguaro, the Custodian has counted thirty-two peccaries in one herd; another member of the monument staff has reported seeing twenty-five in a group. This population has increased definitely in the past five years and is now estimated in excess of two hundred. Peccaries seem to have increased also in Organ Pipe Cactus Monument, although the Custodian cautiously observes that the animals may be merely spreading into well-traveled areas where they are seen more often than formerly. The total number of peccaries in the monument is estimated at 1200. The final park area, Tonto National Monument, contains about thirty peccaries.

Cervus canadensis. Elk.—More than 22,000 elk inhabit the National Park System. (This does not include the so-called southern Yellowstone herd of 15,000, some of which spend the summer in Yellowstone Park.) The vast majority are found in Yellowstone (whose northern and Gallatin herds total 13,300), Olympic (4600), Glacier (3000), Rocky Mountain (800), and Wind Cave National Park (450). Teton Park–Jackson Hole Monument have a permanent elk population of about 400, while several thousand animals of the southern Yellowstone herd migrate through the eastern part of the area each year.

All of the larger elk herds are confronted with a critical lack of winter range. After years of strenuous effort, the Park Service secured enough reduction of the northern Yellowstone herd to bring it barely within the rated carrying capacity of the range. Aided by generally easy winters and above-average rainfall from 1938 to 1945, the vegetation made some progress toward recovery. Unfortunately, the rains of 1946 were short and poorly distributed, and plants made little growth. This was followed by the most severe winter in many years. The elk were forced down on their winter range early in the season and were held there exceptionally late. Only an unscheduled kill of some 1500 elk, over the planned hunting take, prevented a heavy winter-kill. As it was, approximately 500 elk succumbed to starvation and allied troubles. Unless weather conditions become much more favorable, it may be necessary to reduce the herd still further.

Similar difficulties beset the elk herds of the western slope of Olympic National Park. Accurate information on present numbers and migrations of these elk is lacking. In Glacier Park, the elk have doubled since 1934 and still appear to be increasing steadily. They have exceeded the carrying capacity of their winter range. The problem is especially acute along the North Fork of Flathead River, on the western boundary of the park. This area has been

closed to hunting, but it must be opened and the season adjusted to ensure a sufficient kill. Along the south boundary, extension of the usual hunting period has been only partially successful as few elk are forced out of the park except in the more severe winters. Elk bands on the eastern slope are reduced effectively when they descend to the adjacent Blackfeet Indian Reservation.

An official kill of elk in Rocky Mountain Park in 1944–45, coupled with legal hunting east of the park, seems to have resulted in a satisfactory adjustment of a long standing problem in that area. Reports indicate that the remaining animals are in good condition and that the range is not being abused. A request for extension of the usual hunting season east of the park has been made to the State Game Department in order to keep down the numbers without further killing in the park.

Widespread introductions of Rocky Mountain elk (*Cervus canadensis canadensis*) of Yellowstone Park to the original ranges of the Roosevelt and Merriam elk have resulted in adding a new element to the faunas of a number of other parks. A herd of thirty to fifty Rocky Mountain elk wanders at intervals into Crater Lake Park. Some of the descendants of a band that was released west of Mount Rainier in 1932 later drifted into that park. However, these animals have not been reported since 1935 and their present status is unknown. A small group of elk, originally stocked on the Dixie National Forest, have ranged into the west side of Zion Park during the fall and early spring months. A few individuals from the same source have been reported in Bryce Canyon National Park.

Odocoileus virginianus and O. couesi. White-tailed deer.—In the eastern parks, the status of white-tailed deer (*O. virginianus*) ranges from unsatisfactory to excellent. The number of these deer in Everglades is low due to campaigns to control the cattle fever tick and to hunting and poaching before the park was established. The survivors should increase under protection. At Mammoth Cave in Kentucky, the native white-tailed deer was exterminated; an attempt is being made to restock it in the area. In the Great Smokies, deer have never recovered from over-hunting. About thirty animals are estimated to be in the southwestern part of the park. Despite the most strenuous efforts to protect them over the past fifteen years, they have increased but little. Predation by bobcats has been suggested, but it seems more likely that poaching and harassment by dogs are keeping the deer at a minimum.

At Shenandoah Park, a small remnant of the original Virginia deer population was augmented in 1934 by thirteen white-tails of the northern race (*O. v. borealis*) from an enclosure on the Mount Vernon estate. Descendants of this mixture are well distributed over the park and seem to be increasing. Based on a strip count, their number is estimated at 225. In Acadia Park and adjacent territory fairly intensive studies of deer and their effect on the forage are being made. These show that the peak population of the late 1930's, which did considerable damage to the more palatable browse plants, subsided by 1942–43. Poaching, which is quite general on Mount Desert Island, is now holding down the deer or is permitting only a slow increase. Any incipient deer problem apparently is moving from the park, which is growing up to forest and relatively poor deer habitat, on to private lands where lumbering is creating conditions which will be attractive to the animals for years to come.

The plains or northwestern white-tail (*O. v. macrourus* or *O. v. ochrourus*) has been extinct in the Yellowstone–Teton–Jackson Hole region for more than twenty years. At least in Yellowstone, it seems to have been unable to persist after the destruction of its bottomland thickets by the too numerous elk. The white-tail has fared well in Glacier Park, where it is estimated to number 2200 head. Due to winter-kill, coyote predation, destruction by trains of the Great Northern Railway and by snowslides, as well as a small kill by hunters, the population is quite stable. A study is necessary to determine if the winter range of these deer is being usurped by the elk, which are increasing.

Protection of white-tails (*O. v. texanus*) in Big Bend has been effective since 1936 when Texas prohibited hunting in the then State Park. Predator control, however, continued unabated. The deer increased rapidly until 1944 when great numbers died from an unknown cause. Beginning with the Spring of 1945, the population has come back to about two-thirds of the previous level. The animals are in good condition.

Odocoileus hemionus. Mule deer.—The total number of mule deer in the National Park System is estimated at between twenty-two and twenty-three thousand. Many of these emigrate, however, for varying periods each year. The species occurs in practically all of the western areas. Little significant change during the past eight or ten years is reported by Mount Rainier, Lassen, Yosemite, Bryce Canyon, Grand Canyon, Carlsbad Caverns, Grand Teton, and Glacier national parks, and by Grand Canyon and Organ Pipe Cactus monuments. The animals have increased at least fifty per cent during the same period within Mesa Verde, Big Bend, and Wind Cave parks and Lava Beds and Dinosaur monuments.

At Big Bend, the increase is attributed to protection from hunting. The animals are spreading from the mountains into the lowlands where vastly better forage has resulted from the elimination of domestic stock. In Dinosaur Monument, mule deer are abundant and are utilizing the full carrying capacity of the range over large areas. In addition, they are over-browsing the vegetation in Island Park (winter range), Pot Creek–Harper Corner (summer range), and Zenobia Peak (normally summer range, but utilized in winter also). These concentrations, however, are only portions of a widespread "Douglas Mountain problem area." Increased hunting pressure outside of the monument probably would remove the surplus deer from the protected area. Because the region is sparsely settled, the hunting season must be lengthened and killing of does permitted.

A less spectacular but serious problem of long standing is located in two winter concentration areas in Sequoia Park. From a vast expanse of summer range, the mule deer crowd into narrow canyons which are below snow line. Very severe damage to vegetation has been noticeable for at least thirteen years. Experiments in the use of deer repellents were conducted on shrubbery at Giant Forest and a small-scale trapping campaign was carried out. Neither method was effective or even promising. In the meanwhile, cumulative damage has mounted to critical proportions in the Middle Fork–Hospital Rock area on the Middle Fork of Kaweah River, and in the Giant Forest–Wolverton region on Marble Fork. Removal of at least seventy-five deer at once is imperative, after which the population must be maintained below carrying capacity. Two additional winter range areas, which are far larger than the two described, are in good condition.

A similar problem, this time in Zion National Park, has been partially solved. The plateaus and canyons of this park are a portion of a sunny escarpment which attracts a great deer herd during the winter months. About the time of World War I mule deer began to appear regularly in Zion Canyon. Gradually the number increased and damage to the most palatable food-plants became noticeable. Action to save the plant cover and soil in this scenic, heavily used canyon became necessary. From 1938 to the present, over seven hundred deer have been removed. About one-third have been live-trapped and released elsewhere in Utah; the remainder were shot and turned over to state authorities for charity. In Zion Canyon, deer are kept down to small numbers and the vegetation is improving noticeably. In the wilderness areas back of either rim, however, no practicable remedy has been found. Lack of hunters precludes the effective reduction of deer on the autumn range outside of the park.

A small but scenic portion of Rocky Mountain Park near Estes Park village was subjected to over-use by mule deer at least as early as 1930. During the winter of 1944–45, 113 deer were destroyed by shooting. At the same time, 301 elk were removed from the same range. Some improvement in the condition of winter browse species became apparent during the following year. The winter of 1946–47 was unusually severe and food was not available in sufficient quantity. Consequently, although the loss was not excessive the deer emerged in poor physical condition. It is evident that too many animals still remain on the area.

In the northern Yellowstone, mule deer are engaged in an unequal struggle for food with the vastly more numerous elk. The population has fluctuated enormously, depending on the severity of the winters and availability of forage. From 1934 to 1942, the number of deer increased 330 per cent—from 363 animals to 1200 in eight years. However, two die-offs occurred, one in early 1935 and the second in 1943. During the latter, almost half of the deer on the northern winter range succumbed to starvation. Carrion was so abundant that many

carcasses were never touched by the coyotes. Most of the subsequent increase has been removed by hunting in the Gardiner area adjacent to the park. A conservative estimate of the present number is 600. However, accurate information is lacking and a census should be made.

Alces americana. Moose.—Moose are prospering in all of the parks and their future appears satisfactory except at Isle Royale. They are plentiful in Yellowstone, Grand Teton, Glacier, and McKinley parks and Katmai National Monument. Little variation has occurred in recent years except at Teton, where hunting in the surrounding region during 1945 and 1946 caused a noticeable reduction in the number of park moose.

The story of the Isle Royale moose herd has been told many times, although the facts concerning the early stages are obscure. Apparently moose were extremely scarce on the island prior to about 1910. By the early 1920's they were abundant and increasing. In 1930, Adolph Murie estimated the population at one thousand, possibly two or three thousand. Extreme over-browsing was evident. Then came the inevitable crash and by 1935 the moose were greatly reduced. Apparently the number did not vary greatly during the next decade. Growth of shrubs following an extensive fire in 1936, coupled with some recuperation of the unburned forest, made conditions a little easier. At present the moose have exceeded the carrying capacity of the island and are estimated to number at least 650. They are believed to be increasing, perhaps about ten per cent annually. There is no effective predator and it seems unlikely that sufficient reduction could be effected by official control methods.

Rangifer. Caribou.—Woodland caribou are gone from Isle Royale and no mountain caribou have been reported in Glacier Park for many years. Nothing definite is known of the status of Grant's caribou in Katmai, where it may be an irregular migrant or even resident. A reindeer herd that was established on the Alaska Peninsula about 1938, and then poorly managed, may have hybridized the native species. An attempt has not been made for some years to count the barren-ground caribou passing through McKinley Park. The migrations, however, have been generally smaller than those of the 1930's when the herds were estimated to contain as high as 25,000 or even 30,000 animals. During the first half of June, 1947, small bands of caribou wandered eastward through the park, but the main herds either were not observed or they passed north of the boundary. Ordinarily the caribou spend only a few months of the year within the park.

Antilocapra americana. American antelope.—About three-quarters of all park-inhabiting antelope, or pronghorns, are found in the northern portion of Yellowstone. This herd increased from an estimated 600 in 1936 to 800 in 1938 and 900 in 1943. (Fears that the termination of coyote control in 1935 would mean extinction of the park antelope were thus groundless.) The population dropped back to 800 in 1946, but drought and over use had done grave and perhaps irreparable damage to the principal winter food (sagebrush). Accordingly, arrangements were made with the Montana Fish and Game Department to live-trap and remove the surplus. In January, 1947, 235 animals were caught and taken to understocked ranges elsewhere in the state. A sufficient number will be removed in the winter of 1947–48 to reduce the park herd to 400. It will be maintained at this level in the hope that the sagebrush and other forage will recover eventually.

Range conditions are good at Wind Cave and the 150 antelope there are in excellent health. This herd has built up by natural increase from the forty animals that survived disease and the drought of the early 1930's. During the past year, however, illegal hunting on the park destroyed about thirty-five antelope—the equivalent of the estimated annual increase. Petrified Forest in Arizona is a portion of an extensive range which is inhabited by 150 antelope. Hunting outside of the Monument has not been permitted since 1943, and the bands are growing. The buck-doe-fawn ratio is about 1–2–1. At Organ Pipe Cactus Monument a small group of antelope have been augmented by births and by the movement of others into the sanctuary. Two bands totaling about thirty animals are known to be resident.

Bison bison. Buffalo.—In the Lamar region of Yellowstone, range conditions and other considerations have caused the Park Service to effect a material reduction in the number of buffaloes. From a high of 1200 in the early 1930's, the herd has been brought down to an

average of 400 animals. By shipments to game farms and zoos and by slaughter and disposal of meat to Indians, this level is being maintained. Winter feeding of hay has been reduced to that which is essential to bring the herd through the most rigorous winters without excessive loss. Another step in restoring natural conditions has been taken by removing all buffalo fences and by abolishing the captive show herd and display pasture on Antelope Creek.

Two other bison herds in the interior of the park are thriving; that in the Fountain Flats–Hayden Valley region has tripled since 1936 and now numbers 275 animals. They, as well as the 300 bisons in Pelican Creek, winter along lake and creek banks and on areas that are warmed by subterranean heat. The total number of bisons in Yellowstone is about one thousand.

Another thriving herd of 350 is fenced at Wind Cave. It can be allowed to double in size as soon as the recent Custer addition to the park can be enclosed with suitable fencing. Two more small bands of bisons are confined at Platt National Park and Colorado National Monument. The canyon mouths of the latter area are untypical bison range and are badly overgrazed. The animals should be removed.

The Fish and Wildlife Service has given valuable assistance in a program to reduce or eliminate Bang's disease. By testing and then inoculating and segregating the clean animals, it should be possible eventually to establish a disease-free bison herd at Wind Cave. In Yellowstone, the majority of the bisons cannot be trapped and examined. The objective here is to cull the diseased individuals from the Lamar herd through trapping repeatedly over the years. Thus the incidence of Bang's disease can be reduced to a low figure.

Ovis. Bighorn.—Many of the reports concerning the status of bighorns are not promising. The species is extinct in Yosemite Park and apparently it is gone also from Dinosaur and Saguaro monuments. At Zion Park, few animals have been seen during the past decade and these have shown a progressive decline in numbers. Observations in Grand Canyon Park and Monument indicate that the population is low. In fact, no bighorns have been seen in either area for several years. Within the park, a "fair" number of bighorns are believed to live in the Inner Canyon, in the vicinity of the Big Thumb and Copper Canyon; however, this region is rarely visited and no reliable data is available. Likewise, an indefinite report must be made for the Sequoia and Kings Canyon parks. Prior to the war, tracks were seen in the upper Kings Canyon watershed. Apparently bighorns are still extant on the east slope of the Sierra Nevada and occasionally they stray across the divide into the park.

Hunting presumably was responsible for eliminating the bighorn from the canyons of Mesa Verde about 1896. A half century later, fourteen animals from the Tarryall herd were donated by the Colorado Game and Fish Commission and released in the park. These bighorns divided into two bands which have remained in the region. In midsummer of 1947, tracks showed that both bands contained lambs, but the number was not ascertained.

Rocky Mountain Park is the home of about two hundred bighorns. Little change has been noted for at least five years. Very few lambs have been seen during the last two years. The condition of the adults varies from fair to good. At Teton Park, bands of three to five animals have been observed every summer for the past five years. The total number is estimated to be twenty-five and is believed to be stable. Although the bighorns in Yellowstone are handicapped by a scarcity of forage and by competition with elk and deer, they have not lost ground during the last decade. In fact, they may have increased slightly in the first half of the period. The species nevertheless is handicapped by lack of food and subsidiary troubles: disease, parasites, and low reproductive rate. Predation is an unimportant cause of death. The estimated number of bighorns in Yellowstone Park is 280.

Death Valley is an important bighorn habitat, containing four hundred of the animals. Little significant change has occurred in recent years although the bands are known to shift from one range to another, sometimes long distances apart. One important cause of movements is the feral burros. These exotic mammals often monopolize and pollute the waterholes. Accordingly, continuing warfare is carried on against them. Almost one thousand burros have been destroyed in Death Valley National Monument in the past ten years.

Similar conditions prevail in Lake Mead Recreational Area, another important refuge of the wild sheep. The population of bighorns here is estimated roughly at five hundred animals. It is not known whether they are increasing or decreasing.

Bighorns seem to have increased in Organ Pipe Cactus Monument. They have done well in Glacier Park since a serious die-off occurred in 1935–38. At the low point in 1938 only eighty sheep could be accounted for here, while the 1947 population is estimated at 225. All animals seen have been in good condition. The proportion of rams to ewes is about equal. A small annual loss is chargeable to Indian hunters who kill bighorns that drift out of the park onto the Blackfeet Reservation.

In McKinley Park, the Dall sheep (*O. dalli*) were severely reduced during the winters of 1928–29 and 1931–32. For the next ten years, the population apparently did not vary greatly. Between 1942 and 1945, however, it dropped from an estimated 1000–1500 sheep to an all time low of only 500. Now (1947), a long-awaited upturn seems to be taking place. For the second consecutive year, the lamb crop has been good—roughly fifty per cent of the ewes. Survival of 1946 lambs over the past winter also was better than usual. A count of the population in June, 1947, made from the ground and from an airplane, indicates that there are about 600 sheep in the park.

Oreamnos americanus. Mountain goat.—As far as is known, mountain goats are thriving in the three park areas where they are native. In Glacier Park, the population is estimated to number 870; at Mount Rainier, between 350 and 400. No attempt has been made to estimate the number in Glacier Bay National Monument. The staff at Rainier is now trying to make a more nearly accurate count in that area; also, more information is being sought concerning the relationships between goats and other park mammals, particularly predators. In 1927, mountain goats were introduced into the then Mount Olympus Monument by county game authorities. The animals increased, although rather slowly, and are now seen occasionally in a number of places in the Olympic National Park. Goats may be expected to invade Yellowstone Park from a planting made about 1942 by the Montana Game Commission on the Beartooth Plateau outside of the northeast corner of the park.

SIRENIA

Trichechus latirostris. Manatee.—The manatee has been comparatively rare along the South Florida coast for many years. The target of backwoodsmen, fishermen, and pleasure seekers, it has been in dire need of protection. For some time, those survivors that frequented the south and west shores of the Everglades have been watched with special vigilance by the wardens of the National Audubon Society and the Fish and Wildlife Service. At least until 1946, manatees have been seen with increasing frequency in the Florida Bay–Whitewater Bay–Shark River region. During the winter of 1946–47, several dead manatees were found. No recent information is available concerning the cause or extent of the mortality. However, the winter was unusually cold and it would be surprising if this did not exact a considerable toll of these tropical mammals. The manatee will be given the greatest possible protection in the Everglades Park.

SUMMARY

The great majority of the mammals that inhabit the National Park System are present in normal numbers. They appear to be in satisfactory adjustment with their environment and with other species of animals. There are, however, a number of maladjustments and problems of abnormal relationships. Some of these are caused by artificial boundaries and inadequate size of park areas. Others result from man's occupation of the parks or the regions surrounding them. Still others jeopardize the support and cooperation of the local communities which are necessary if these areas are to function effectively as wildlife sanctuaries. The following types of problems are most urgent:

1. Species which have been extirpated or reduced beyond their power to recover must be restored by restocking. Examples: black bear at Everglades; badger at Wind Cave.

2. Depleted species that require assistance against enemies. Examples: desert races of bighorns that are in competition with burros in southwestern areas; Dall sheep of McKinley Park which at times may require assistance against wolves. This particular problem is complicated by the fact that the wolf is itself a vanishing animal.

3. Rare species that range widely and are important economically. Examples: grizzly bear in Yellowstone and Glacier parks; fisher and wolverine in parks of the Sierra Nevada.

4. Diseases in park mammals that may be of serious consequence to wildlife, domestic animals, or man. Examples: rabies in carnivores; Bang's disease in buffaloes of Yellowstone and Wind Cave parks.

5. Overpopulations of mammals and threatened destruction of vital forage. Examples: elk and antelope in Yellowstone; mule deer at Rocky Mountain, Zion, and Sequoia parks.

6. Wildlife–visitor relationships. Examples: protection of visitors from black bears (and vice versa) in Yellowstone, Great Smoky Mountains, and other parks.

7. Illegal hunting or trapping that may threaten the continuance of rare or depleted species. Examples: rare fur-bearers of many parks.

8. Dispersal of park-reared predators to areas where they may compete with man's interests. Examples: coyotes and cougars in numerous parks.

Biology Division, National Park Service, Washington 25, D. C. *Received September 12, 1947.*

NOTES ON THE CANADA PORCUPINE

By Charles Foster Batchelder

At intervals during the years 1929 to 1933 a Canada porcupine (*Erethizon dorsatum*) made her den in space inside the rather rough stone foundation of a large old wooden barn about a hundred feet from my house in Peterborough, New Hampshire.

Along the side of the barn, at the edge of the lawn between her den and the house, is a deep border of rhododendrons and taller shrubs; on this part of the lawn are a dozen half-grown American elms and two large clumps of lilacs; and, but a few yards from the house, a row of three old elms, tall, and over three feet in diameter. Here the porcupine frequently appeared, going about her affairs with little regard for any human beings that might be present, provided they did not crowd too closely upon her or produce very disturbing noises. And here, too, I lost few of the many opportunities she afforded for watching and listening to her from under a tree she was in, or often from an open window in the middle of the night.

I am offering now some of my notes, most of them just as they were jotted down at the moment, rather than suffer loss of exactness by generalizing them.

September 23, 1930.—In October, 1929, the mother and cub that frequented my lawn disastrously slashed the upper branches of several young elms, and browsed so extensively on one of a large group of arbor vitaes that, at the time, I despaired of its recovery. The porcupine this year, probably the same adult, has not touched these young elms, nor the arbor vitae, but has confined itself almost wholly to the western of the large elms, though occasionally, too, nipping a few twigs from a neighboring apple tree. I cannot avoid the surmise that its actions last year were for the purpose of teaching the cub to climb and browse in trees, and that it chose trees easy for the cub to climb.

This morning, as twilight was brightening into day, the presence of a skunk near the house was evident, and a party of crows swooped low over the lawn for a few moments, apparently investigating it. The porcupine, which was on the lawn, paused and turned, plainly watching the crows, perhaps also considering the skunk. Then it started toward its camp under the barn, but immediately returned, moving at a rather rapid gait—it looked like two or three miles an hour—and seeming disturbed. I suspected that it found, or feared, that the skunk was taking possession of its quarters.

June 4, 1931.—For the past four weeks, on most of the mornings, under the westernmost of the three big elms in front of the house—the porcupine's favorite tree—we have found one or two little branches, bitten off and stripped of their foliage. Not infrequently we have seen her browsing on the lawn or traversing it between her den under the barn and this elm. This has been before dark, in the earliest twilight or before sunset, once this week as early as 6:30 P. M., Eastern Standard Time. Usually on these occasions she has gone straight to the elm, climbed high into its branches, and remained there at least so late into the night that we had no way of knowing when she came down.

Late this afternoon I had an opportunity to watch her climbing the tree. She was ascending a large upright limb a foot and a half or more in diameter. Grasping the tree firmly by stretching all four limbs around it, she reached up with her right arm, followed instantly with her left. Gripping with them, she swung her hind limbs simultaneously upward beneath her body, a surprisingly long swing, and from this new hold immediately repeated the action in the same order, traveling upward at a speed that seemed surprisingly rapid for an animal of her weight and apparent clumsiness.

June 23, 1931.—In the early twilight the porcupine appeared, running across the lawn in

a bee line from the corner of the barn to the western elm. She lost no time in starting up the tree on her usual (south-southwestern) side. We got there when she had ascended some twenty feet, and watched her till she disappeared at about three quarters of the height of the tree. She climbed as before, except that in the upward swing of the hind limbs the two were not always moved with such absolute simultaneousness as on June 4.

We noticed, too, what I had not observed before, that immediately after the hind limbs were swung forward, or just before, the tail was pressed closely against the tree, apparently for additional support, and was held so while the right arm, and then the left, were advanced to their new holds.

July 9, 1931.—This evening, at early twilight, I watched the porcupine climb the trunk of the elm. Her use of her tail as a support in climbing, at the moment of swinging the hind limbs forward, noted June 23, was quite obvious. The trunk is none too easy to grasp, for at six feet from the ground the tree has a circumference of nine feet and six inches.

July 13, 1931.—Last evening at 7:15, still daylight, the porcupine appeared, moving briskly across the lawn from the barn to its tree. I reached the tree, when it had ascended but a few feet, and watched it as it hastened up the trunk. I noticed that, in using its tail for support while shifting its hind feet forward, the upper part of the tail is bent inward toward the tree, and the lower part (perhaps three-fifths of the length) is held parallel with the trunk, that is, there is a distinct bend in the tail at a point about two-fifths of its length from the base.

Tonight in late twilight, and light rain, the porcupine and her cub—which is quite small—appeared on the lawn. Again and again the cub left its mother and dashed off in one direction or another, running surprisingly fast. Presently they visited an apple tree and climbed it. The cub started up first, and on the approach of two persons the mother, who was on the ground, retreated up the tree, but on the opposite side to the cub, the latter meanwhile climbing high, into slender branches. The cub tried gnawing one branch too stout for it, then a smaller one.

July 26, 1931.—Last night the porcupine climbed in the elm. The light over the front door a few yards away, which I switched on trying to see her, did not seem to disturb her at all.

She is a wasteful feeder. A slender elm branch she had dropped, cut off diagonally by a stroke of her teeth, was four and a half feet long, and a full half inch thick at the butt. It bore about a hundred leaves, thirty of which were untouched. Of the remainder, some were stripped to their petioles, about half of the leaf remained on others; hardly half of the leaf tissue of the branch had been consumed. Lying on the ground with this branch were one or two smaller twigs with their leaves untouched.

August 4, 1931.—At 6:48 P. M., in full daylight, a clear, still evening, the porcupine left the barn and traveled briskly by her usual route to her big elm. The route starts in tall, open shrubbery by the barn, crosses a short stretch of open lawn, passes through the edge of some dense shrubbery, and crosses more lawn and a brickwalk to the tree—a hundred feet or more in all. When she was in the middle of the first piece of open lawn an electric bell rang in the house some eighty feet away. Instantly she stopped, listened a moment, but apparently decided the sound meant no danger and resumed her course.

A few days ago, when she was at the same point, sedately moving along in this usual evening excursion, there was a slight clatter of tinware at the kitchen sink a hundred feet away. I hardly noticed it in an adjacent room, but the porcupine turned at once, and ran at full speed back to shelter.

Tonight when she reached the tree she went rapidly up it, as always on exactly the same side of its almost cylindrical trunk, paused a moment in a crotch at a third of the height of the tree, and then went on up to perhaps four-fifths of the height and along a straight limb three or four inches thick. At a cluster of small, slender branches she stopped and began feeding diligently. At that height, in the fading light, I could not clearly observe details, but she appeared to devote her attention to one slender branchlet some three feet long, and to consume it completely. One little twig, with a few leaves, alone floated down.

After ten minutes thus busily spent, she stopped eating and started down. She traveled

quickly about twenty feet down this limb and a steeper, larger one to a crotch, whence, with hardly a pause she climbed up in a more central part of the great tree until I almost lost sight of her in a tangle of small branches hardly ten or fifteen feet below the topmost twigs of the tree. In descending these branches, she moved backward along the limb, apparently exactly reversing the action of her movements in ascending the tree.

August 7, 1931.—About 9:50 P. M. I found the porcupine going up the trunk of the elm. Following a few feet below her, was her cub. He is quite small; he appeared to be about a quarter of the bulk of his mother.

He climbed slowly and hesitatingly, feeling his way, showing no trace of the firm, assured 'gait' of his mother. He reached out his hand and tried several tentative holds before he obtained a grasp to which he dared trust his weight. His air of inexperience and timidity as a climber contrasted strikingly with his mother's vigorous, rhythmic, almost automatic action, as she briskly pulled herself up the tree. His hesitation and slow movements soon left him behind his mother whose voice was to be heard occasionally from some point far out of my sight in the branches overhead.

At about twenty feet from the ground the cub appeared to become dissatisfied with his choice of a route up one large upright limb and backed slowly down until he could shift across onto another closely adjacent one. Up the latter he traveled until I lost sight of him among the shadows some thirty feet up. (For convenience I have been writing of the cub as 'he;' of course I have no evidence of its sex.)

August 11, 1931.—At 9:35 P. M. I heard the sharp, crunching sound of the porcupine's claws on the elm tree. By the front-door light I found her a short distance up the tree, and then by an electric torch I observed her more closely. Although easily disturbed by very slight sounds, she usually seems to pay no attention to light, even to a sudden bright one. Tonight, however, when my small torch shone on her, twenty feet up the trunk, she stopped climbing, turned her head, and for some time, perhaps half a minute, gazed inquiringly at me or at the light. I did not move, and finally she went on up the tree.

October 15, 1931.—Porcupines in the sweet-apple tree. At 7:45 A. M. I met the mother returning to her den under the barn. Disturbed by our presence, she did not deviate from her straight course, but quickened her pace from a slow run—her usual gait—to a gallop. As she went, she carried her tail uplifted, presenting a queer-looking profile. I went on to the sweet-apple tree and found the cub, now about half as big as its mother, up in one of the outer branches. For a few moments, as I stood under it, it remained absolutely motionless, facing me and apparently watching me. Half an hour later—it was reported—the cub left the apple tree and went off by itself, not to the den, but up the hill into the woods.

May 7, 1932.—Soon after last October 20 the porcupine disappeared from the neighborhood of my house and there were no signs of her there all winter—no tracks in the snow, no droppings.

We had long considered our share, at least, of this porcupine's history quite ended, and were greatly surprised tonight to see a porcupine on the lawn. It was still daylight at 6:15 P. M. when she appeared not far from the barn. That it was the same animal, was at once apparent. As I watched, she made a bee line across the lawn to the big elm—the one she always visited in the other years—and went up it on the side she always had climbed before.

She ascended deliberately, but not slowly, pausing now and then to nibble some twig she came upon on her way. She went up a considerable distance, then apparently changed her mind, came part way down, and chose another of the numerous large ascending limbs. Up this she went, showing the same action I have described before, stopping occasionally to feed on some attractive branchlets, then going on again until she reached what seemed dizzying heights to the watcher below. The elms are fine old trees towering high above the house; probably they are about eighty feet to their tops.

Her real feeding grounds are among the smaller branches in the tree top, chiefly within ten feet or so of the topmost twigs. The tree is not yet in leaf; the fruit, a rather light crop, is not qute fully developed, so, with plenty of daylight, I had an exceptionally favorable chance to observe her actions.

She traveled up a limb till she reached a spot where the long, slender branchlets she likes were within reach. Then, holding on, she reached out one hand and drew in one of these little branches, bit it off, and proceeded to eat it—or as much of it as she saw fit. She held the stem with one hand, sometimes with both, passing it horizontally through her mouth. Most of the branches she cut were one and a half to two feet long, though once or twice she took one that must have measured four or five feet.

When she had occasion to use both hands in eating, she plainly had no trouble in holding herself securely with her hind feet alone. As she fed on, ever upward, she reached slender branches, no more than an inch or two in diameter, that swayed with their not inconsiderable burden. It did not seem to disturb her equanimity in the least. To me, on the ground, there was a perceptible thrill watching her distribute her weight on two or three exceedingly slender branches and then slowly stretch out one hand to the uttermost and draw toward her another branch, sometimes none too flexible, until her teeth could secure the twigs she wanted. I learned to respect the steadiness of her nerves and the strength of her powerful muscles. She climbed with almost as much air of self-confidence as a monkey, but of course with none of its speed.

In shifting her feeding ground from one limb to another, she backed down the limb, practically reversing the ascending action, until she reached the crotch of the two and then ascended as usual. Once, however, when she wanted to cross from one slender limb to another close to it, she reached out with both hands, grasped the further limb, and swung herself across onto it.

She seemed to have a most excellent appetite. I watched her from 6:15 until 7:30 P. M. when in the gathering darkness she was hardly more than a shapeless blot against the sky, and when I left her she was still diligently devoting herself to the pursuit of her supper.

May 19, 1932.—At 10:50 A. M. the porcupine appeared from the direction of the barn and climbed her big elm. When I arrived fifteen minutes later, I found her high up, far out on an overhanging limb. There she moved about, browsing in a deliberate manner, going as far out on one branch as she well could, retreating to a crotch, and then following out another. As she traveled along a limb she paused a moment on her way to nibble a twig here and there, and when she reached a good feeding ground she stopped to devour the dainties within reach. Sometimes she fed stretched lengthwise on a limb; at others she sat somewhat upright, often crosswise of the branch, holding on with her hind feet while she reached out with one hand to secure her food. Very rarely did she drop a cut-off twig to the ground. She would reach to a slender, flexible branchlet two or three feet long, bend it in toward her, and, holding it with one hand, or sometimes with both, pass it through her mouth, rapidly nibbling off the tender sprouting leaves and the fruit. In handling the twigs as she ate, she seemed ambidextrous. I could not see that she used either hand less often or less skilfully than the other. In the use of her hands she showed an ease suggestive of a squirrel or almost of a human being.

Several times she stopped eating to scratch her chest or side with one hand. Once she stopped and shook herself much as a dog would. Several times she stopped and rested—apparently took a nap for a few minutes. Once this was lengthwise on a branch with her arms and legs half hanging on either side; at another she rested her body across two slender two-inch horizontal branches, grasping one with her hind feet and clasping her arms loosely around the other.

When she had eaten all she wanted on one branch, she shifted to another, always backing down the branch if it was steep. If she came to a place where the branch was fairly horizontal, if only for a length of ten or fifteen feet, she sometimes turned around—a slow process on a very slender branch—and traveled forward until a steeper slope led her to turn again and go down backward once more.

At 12:36 P. M. she settled herself lengthwise on a sloping limb at a point where a more upright branch formed a crotch, backed down into the crotch with her tail a little to one side and her legs and arms clasping the limb, and seriously went to sleep. Not until 2:10 P. M. did she stir, in spite of considerable loud talking, a lawn mower underneath her, and an

automobile coming and going close by. Then she moved a few feet up the limb and settled down again. With one other slight shifting of place she remained there in apparently unbroken slumber until 5:40 P. M. Then, with a little stretching and shaking herself, she settled back into the crotch for an hour's more nap. At 6:40 P. M. she aroused, shook herself rapidly, scratched her belly first with her right hind foot then with her right hand, and at 6:48 P. M., just as the sun was setting, started up the limb. But indolence seemed to prevail, for she went only a few feet before she stopped. About 7:00 P. M., just as sunset was giving way to twilight, she began to bestir herself with tentative movements and a little scratching (of side by right foot), and moved a little way; but she seemed loth to leave the comfort of her bed, and settled down. At 7:20, with twilight deepening, she started slowly down the tree. After going two or three yards, she stopped, perhaps disturbed by some one passing down the brick walk. In a few moments she climbed back nearly to the crotch where she had slept. There she remained motionless, fading into a dim spot against the sky as night came on. Just before eight o'clock she started down the tree, and as the clock was striking she reached the ground and disappeared in the darkness.

May 25, 1932.—At 6:10 tonight, thinly clouded but daylight, the porcupine appeared on the lawn, marching briskly toward her elm. She had just reached the first lilac clump when some one in the kitchen coughed slightly. She stopped instantly, turned and galloped to the shelter of the shrubbery at the side of the barn. There she stayed a couple of minutes before starting again for the elm. This time she moved very cautiously, stopping more than once to listen for danger. Reaching the accustomed side of the tree, she started up promptly and went on diligently until she had climbed to more than two thirds the height of the tree. At this point some choice twigs tempted her to stop several times to nibble for a minute or two. The climb to that height had taken her three minutes and a half.

May 27, 1932.—About 6:55 P. M., in the heavy rain of a thunder storm, the porcupine walked across the lawn to the elm and climbed it.

May 30, 1932.—About 6:05 P. M. (sun shining) the porcupine was on the lawn. Inside the house, but the doors open, I sneezed; the porcupine hurried to the shelter of the barn shrubbery; apparently she did not come back later.

Much has been written about the food of porcupines. It seems to vary, geographically and seasonally, perhaps partly according to what is available. In the western United States they are said to do serious damage to coniferous timber by eating the bark in the tops and so girdling the trees. I have not heard of this taking place in the East. Here they are charged with destructive attacks on vegetable gardens and on corn fields when the ears are ripening; how much this amounts to it is difficult to judge, for the porcupine, unfortunately, is an unpopular animal. Succulent plants that grow in the edge of ponds or streams, are, in season, a favorite food. None of this have I had the opportunity to observe. What has come within my own experience, their eating the twigs and foliage of trees and some low herbage, may probably happen to be representative of the greater part of their diet in New England.

Among the rather large variety of deciduous trees occurring in my neighborhood, the porcupine appears to prefer but a few species. In the woods, the red oak, in September at least, is apt to have beneath it small branches diagonally severed by the porcupine's powerful incisors. Apple trees are sometimes browsed upon. For several years a large sweet-apple tree in my orchard had the ground under it strewn with twigs once or twice in August, never at any other season, but the surrounding trees were not touched. I once found the snow beneath a big hemlock liberally sprinkled with twigs of its cutting. Once, too, I found a half-

grown porcupine feeding in the top of an aspen. Probably the list might be considerably longer, yet some of the commonest trees have never, to my knowledge, been visited by porcupines.

Porcupines are especially fond of anything with a salty taste. In the Adirondack woods I have known oars, and indeed any wooden article frequently in contact with human hands, to suffer destructively from porcupines' teeth. Once on Mount Mansfield, Vermont, I saw workmen placing new sills in a corner of a barn under the cows' stalls; porcupines had gnawed the old sills almost through for the attractive flavor that the cows' life there had given them.

My first acquaintance with the voice of the porcupine that formed the principal subject of my observations, was on one moonlight night when, looking out of the window, I saw her busily browsing on the lawn and uttering notes that in quality had an extraordinary resemblance to the human voice. This 'talking' I described in this Journal in May, 1930 (11:237–39). These human-like sounds, her most frequent utterances, which I expressed as *'déahp,'* though as a rule clearly articulate, were not always absolutely so, and once or twice were interrupted by a loud inarticulate squeak.

Further experience I had of watching her brought a great enlargement of my knowledge of her vocabulary. It was really very varied, although the *déahp* notes were more frequent than all the rest. Some of the other sounds, indeed, might be classed as remote variants of the *déahp*.

From my many notes taken on the spot, in which I attempted to express what she uttered, I am taking the following extracts in the hope that, to some degree, they will convey a picture of her speech.

August 30, 1930.—A porcupine under my bedroom window, talking *déahp* not very articulately. It varied in loudness and rapidity, the most rapid perhaps nearly twice a second. She stopped occasionally for a few moments; kept it up about fifteen or twenty minutes. The latter part of the time it subsided to a soft, almost inarticulate murmur with a caressing tone. This was interspersed irregularly with a loud *chuck* or *chauk*.

September 17, 1930.—10:05 P. M. Dark, air still. For a moment at a time, every few minutes, *déahp*, mournfully and rather indistinctly. Rapidity perhaps 80–120 per minute. About 10:30, in the west elm, she uttered two or three *déahps* at a time at intervals. Then at irregular intervals a thin flat squeak. At its loudest and most distinct it was like a weak, high, yapping bark of a little dog.

After eleven o'clock I heard the *déahp*, not quite distinct. Then it shifted into a slightly louder *coo-coo-coo-coo-coo-coo-coo-coo-coo*. Presently, at intervals, an explosive, whining, almost hissing snarl; later, about midnight, frequent faint murmurs, almost inaudible, gentle, little grunts.

September 23, 1930.—From 4:15 to 5:10 A. M. this morning, and again at 6:30 after the sun was well up, the porcupine was about the lawn. It 'talked' at frequent but varying intervals, giving the *déahp* sound a number of times in succession, but with only moderate distinctness. It varied in rapidity, and when the speed increased the pitch rose and the voice grew louder.

September 30, 1930.—At 9:45 P. M. a low *déahp*ing, followed by sound of claws on the western elm. Then, apparently as it climbed, gentle murmuring *déahps* interspersed with sudden snarling squeaks, harsh in quality and some of them really loud. At 11:45 P. M., coming down the tree, it uttered loud squeaks—swishing, almost whistling squeaks (*wheyah* to *whee-yee*) followed by a rapid succession of endless long and short variants of this squeak,

growing gradually less loud then very gentle and faint, but usually keeping the swishing, whistling quality. The louder notes were somewhat suggestive of a boy's first experiments at 'blowing grass,' but smoother, less harshly penetrating.

At 12:30 A. M., at intervals of a few minutes, weak *dĕahps* followed by the swishing squeaks, thinner and finer. Afterward, a few detached inarticulate clucks.

October 6, 1930.—At 4:00 A. M. the porcupine began with some remote-sounding *dĕahps*, then occasional whining squeaks and several times an explosive cry, *kwa*, with a hollow quality suggestive of a night heron, but shorter.

October 31, 1930.—At 4:15 A. M. I was roused by the porcupine giving vent to loud, squeaking cries. They were high-pitched, varying much in form, exclamatory, uttered in close succession in groups. The whole performance lasted but a very few minutes.

June 4, 1931.—For the past four weeks or more the porcupine apparently has been in continuous residence. To my increasing surprise, during all the time my household has been in Peterborough this spring no one of us has heard a sound from the porcupine. The still night air has brought frogs' notes from far away, but the porcupine, close at hand—her favorite elm tree stands barely twenty-five feet from my bedroom window—has been utterly silent.

June 9, 1931.—After her long silence we heard the porcupine this morning at 2:00 A. M. It was a night of heavy rain following two rainy days. For a few minutes she said *dĕahp* continuously, not loudly nor very distinctly, but rather rapidly. Then the sounds faded away as if the animal were moving off toward its den.

July 3, 1931.—At 7:30 P. M., still full daylight, the porcupine was heard talking *dĕahp* loudly and distinctly under a bush by the barn. She did it a few times, then, disturbed, she stopped and went off. At 11:00 P. M. she *dĕahp*ed for a few moments; again at 11:10 or 11:15, twice for a moment with a few minutes interval.

July 15, 1931.—At 2:25 A. M., starlight, still and cool, the porcupine 'spoke' several times at intervals of a minute or two. The speech was hardly articulate, the *dĕahp* being reduced to a *por-por-por*.

July 18, 1931.—Tonight, about 11:00 P. M., the porcupine several times uttered a few repeated notes, almost a moaning sound, like *mŏă-mŏă-mŏă*.

July 20, 1931.—At 2:30 A. M., several times, for a few minutes each, she talked mournfully and half distinctly, uttering something between *mŏă-mŏă-mŏă* and *dĕahp-dĕahp-dĕahp*.

July 26, 1931.—Last night at 12:10 A. M., the porcupine began talking—with pauses—*peĕ-ah, peĕ-ah, peĕ-ah*, or oftener *toú-toú-toú-toú*, or *toú-ah, toú-ah*, always in a mournful or plaintive tone. In manner and form the sounds were entirely similar to the typical *dĕahp* notes, but were less distinctly articulate. She kept it up, with the pauses, for ten minutes or more.

August 7, 1931.—At 12:15 A. M., a still, warm night, with dim rising moon. *Dĕahp, dĕahp, dĕahp*, or *coah, coah, coah*, was heard rather indistinctly, and apparently from a distant part of the lawn, at intervals of a few minutes.

August 26, 1931.—Last night and the night before the porcupine was heard several times, once uttering the *dĕahp* notes quite articulately.

August 28, 1931.—At 4:05 A. M. (a rainy night, trees dripping), dim, early twilight, I was waked by the porcupine. She said *dĕahp, dĕahp*, at first. After that, several times, *por, por, por*, etc. Again, at 4:30, almost daylight, she talked, usually rapidly with pauses, each time saying *por, por*, etc. a dozen to twenty times in succession.

October 20, 1931.—At 1:50 A. M. I heard the porcupine in front of the house uttering an unfamiliar note. It was a rather high-pitched squeak with a rising inflection suggestive in quality of the sound made by two tree branches rubbing together, and ranging from that to the plaintive cry (not the mew) of a cat. It had a slight tendency to divide into two syllables. It was uttered with varying rapidity, at the slowest about once in two seconds. With frequent short pauses, it continued for five or ten minutes. Half an hour later I heard it again for a few moments.

About four or five o'clock she was heard talking for some time in one of the familiar varieties of the *dĕahp* notes.

June 1, 1932.—At 9:50 P. M., a cold, dark night, I heard the porcupine on the lawn. Her notes were something between *poah* and *dĕahp*, uttered in rapid succession, half-a-dozen times or so, querulous in tone, and rising in pitch. We heard this several times; then she went away or stopped talking. (There is some reason to believe that our porcupine was killed by a motor car, June 6)

Some experience of others, that they have reported to me, may be worth noting here.

Michael Egan, an intelligent observer who was in my employ for many years, told me once that, coming to work very early one morning, he thought he heard some children talking in the barnyard, but it turned out to be "nothing but a porcupine."

On June 12, 1935, E. Foye Brown, talking of animals' voices, told me he had heard porcupines uttering sounds that sounded just like the talking of a woman with a rather high-pitched voice, or of a child. He had heard porcupines 'talking' in this way in their dens. These experiences were in the neighborhood of Peterborough.

Under date of May 13, 1920, Dr. John B. May wrote me as follows: "In the summer of 1913 . . . I climbed the south slope of the Squam Range [New Hampshire] through trailless woods. As I came down, quietly and alone, I was surprised to hear, a little to one side, an old man mumbling to himself. I was more than a mile from the nearest road or farm, in pretty rough ground, so I turned aside to investigate. In a small alder swamp I found a good-sized porcupine, feeding near the top of an alder and talking to himself very much as you describe the sound, *dĕahp-dĕahp*, etc. This was about four o'clock in the afternoon as nearly as I can place the time now, and I do not think it was particularly cloudy or dark."

The great variety of the porcupine's utterance is emphasized by the fact that the occasionally uncouthly harsh sounds that it gives forth are offset, perhaps only rarely, by actually musical tones. Here I may quote Miss Margaret Perry of Hancock, New Hampshire.

"When, in the spring of 1944, my niece and I moved into an empty house in Hancock, she was much concerned because from a shed at the back of the house, night after night, she heard plaintive sounds, as of distress, from some creature. A few nights later I stood with her in the dark, listening at an open window. After half an hour we heard the sound very distinctly. Some creature was producing an ascending broken chord, or arpeggio, within the compass of an octave, and then coming partially down the chord again. It was definitely a musical tone, although the intervals did not fit into the human diatonic scale any more than does the song of a bird. These sounds, often repeated, were answered from time to time by plaintive high whimperings like those from a very young puppy.

"The tune, if one may call it by that name, varied slightly, but always conformed to a general pattern. (The tone, however, was at times very soft and pleading, at other times, louder and more preemptory.)

"As we listened, there was a certain amount of scuffling and shuffling about, interspersed with the musical tones and the whimpering answers. Finally it grew light enough to distinguish two shadowy forms. A large mother porcupine was trying to persuade her infant to leave the security of the shed. Time and again the baby would clamber out, even onto the lawn, only to scamper awkwardly back to its accustomed home. At no time did he get more than twenty-five feet from the shed door. As the daylight increased, the mother and baby retired to the safety of their home.

"A few weeks later, picking blueberries in a thickly grown ferny pasture, I heard similar sounds, though the tune was not quite the same. Since then I never have heard the voice of the porcupine, although porcupines abound in our part of the world."

There appears to be a not uncommon impression that the porcupine, if not a dull-witted animal, at least possesses rather feeble physical senses. My experience leads me to somewhat opposite conclusions except perhaps, to some degree, in the matter of its eyesight. As to the latter sense, the animal is indeed largely nocturnal; yet it may be found going about its affairs at any hour of the twenty-four. One piece of positive evidence in favor of its having competent sight is the

fact that the one that has been the principal subject of my observation, in going to and fro between her den and her favorite elm, has almost invariably followed a very direct course, and in case of a sudden alarm has never failed to head in the exact direction of home.

In these pages I have cited a number of striking instances of this porcupine's exceptionally acute hearing, and of her alert response to it. That her muscular sense was of high degree, is amply proved by her secure and confident climbing.

In regard to taste, the fact that the one sweet-apple tree is the only tree among numerous varieties in my orchard that I have at all often known browsed in by porcupines, is rather definite evidence. And how successive porcupines selected that particular tree, unless by a discriminating sense of smell, would be hard to explain. If by 'trial and error,' most of the neighboring trees should have shown signs of having been visited.

On those who discredit the porcupine's talents, rests a considerable burden of proof.

Peterborough, New Hampshire. Received March 3, 1948.

ECTOPARASITES FROM A SERIES OF TEXAS COYOTES

By Richard B. Eads

A large number of coyotes recently trapped by personnel of the Division of Predator and Rodent Control of the United States Fish and Wildlife Service have been examined for ectoparasites. The coyotes, *Canis latrans*, and a few wolves, *Canis niger rufus*, were trapped alive from widely separated parts of the state. It is thought that the series of animals examined is of sufficient number to give some idea of the species of arthropods parasitizing coyotes in Texas.

Ectoparasites of coyotes are of public health significance due to the possible association of the animals with domestic dogs, and the consequent possibilities of human infestation. To illustrate the close relationship between dogs and coyotes, Dice (1942) described the controlled mating of two different male hounds with a female coyote which produced a litter of one male and two female hybrid pups.

The ectoparasites were removed immediately after the animals were killed, and mailed to the Laboratory of the Texas State Department of Health in Austin for identification.

This report is based on the ectoparasites taken from ninety young and adult coyotes. In all, 2280 specimens were obtained with a resultant average of 25.3 ectoparasites per coyote. Three species of fleas were taken: *Pulex irritans*; *Echidnophaga gallinacea*; and a single female specimen of *Orchopeas sexdentatus*. Six species of ticks were obtained: *Amblyomma americanum*, *Amblyomma inornatum*, *Amblyomma maculatum*, *Dermacentor variabilis*, *Ixodes cookei*, and *Ocotobius megnini*. Two species of Mallophaga or biting lice were also taken, *Heterodoxus spiniger* and *Trichodectes canis*.

Dr. J. Bequaert kindly identified the *Ixodes cookei* specimens. Dr. W. L. Jellison checked the single *Orchopeas* flea, and Dr. E. W. Stafford determined the biting lice.

TABLE 1.—*Ectoparasites taken from Texas coyotes in 1946*

DATE	NUMBER OF ANIMALS	LOCATION	ECTOPARASITES	
			Fleas	Ticks and Lice
April 29	1	Floydada	65 *Pulex irritans*	
April 18	3	Floydada	92 *Pulex irritans*	
May 7	9	Childress	79 *Pulex irritans* 2 *Echidnophaga gallinacea*	
May 22	3	Vernon	53 *Pulex irritans*	5 *Ixodes cookei*
May 12	10	Childress	292 *Pulex irritans*	
May 7	2	Floydada	89 *Pulex irritans*	
May 13	5	Dickens	119 *Pulex irritans* 4 *Echidnophaga gallinacea*	
May 15	1	San Antonio	10 *Pulex irritans*	2 *Dermacentor variabilis* 10 *Amblyomma americanum*
May 25	2	Jayton	8 *Pulex irritans* 4 *Echinophaga gallinacea*	
May 27	18	Childress	329 *Pulex irritans* 1 *Echidnophaga gallinacea*	
May 27	3	Lubbock	69 *Pulex irritans* 3 *Echidnophaga gallinacea*	
June 1	8	Floydada	478 *Pulex irritans* 5 *Echidnophaga gallinacea*	
June 10	5	Crowell	21 *Pulex irritans*	5 *Heterodoxus spiniger*
June 10	3	Floydada	193 *Pulex irritans*	
June 28	4	Vernon	33 *Pulex irritans*	11 *Dermacentor variabilis*
June 30	1	Sierra	11 *Pulex irritans*	
July 23	2	Floydada	35 *Pulex irritans* 1 *Orchopeas sexdentatus*	2 *Dermacentor variabilis*
August 8	3	Floydada	13 *Pulex irritans*	2 *Dermacentor variabilis* 2 *Ixodes cookei*
August 27	1	Austwell		1 *Amblyomma inornatum* 14 *Amblyomma americanum* 1 *Dermacentor variabilis*
October 4	4	Floydada	35 *Pulex irritans* 3 *Echidnophaga gallinacea*	
November 15	2	Victoria		16 *Amblyomma maculatum* 150 *Trichodectes canis*

Animals from Floydada were trapped and combed by T. J. Sparks; those from Childress by H. W. Fite; from Vernon, R. E. Morton; from Dickens, C. R. Sparks; from San Antonio, W. J. Hall; from Jayton, S. H. Paine; from Lubbock, E. S. Pope; from Crowell, J. R. Watson; from Sierra Blanca, J. H. Tate; from Austwell, P. O. Davenport; from Victoria, Tennessee Colony, and Marlin, A. J. McKinney; and from Woodsboro, R. O. Calhoun.

All but one of the coyotes examined (Table 1) were infected, some heavily, with *Pulex irritans*. An average of 22.5 *Pulex irritans* per animal was obtained. This flea readily attacks humans and has been experimentally proven capable of transmitting endemic typhus and slyvatic plague from animal to animal. Other Texas State Health Department host records for this flea are dog, man, raccoon, opossum, bobcat, gray fox, prairie dog, domestic rat, wolf, badger, and burrowing owl.

A less severe infestation of another flea, *Echidnophaga gallinacea*, was noted. Only twenty-two specimens were taken. This flea is commonly called the chicken flea because it builds up its largest numbers on gallinaceous hosts. *Echidnophaga gallinacea* have been found naturally infected with endemic typhus rickettsia and proven efficient vectors of the disease from rat to rat by personnel of this laboratory. Other Texas State Health Department host records are domestic rats and mice, man, wolf, dog, calf, owl, opossum, raccoon, fox, cat,

TABLE 2.—*Ectoparasites taken from Texas wolves in 1946*

DATE	NUMBER OF ANIMALS	LOCATION	ECTOPARASITES	
			Fleas	Ticks and Lice
May 22	1	Vernon		4 *Dermacentor variabilis*
May 29	2	Woodsboro	14 *Echidnophaga gallinacea*	3 *Dermacentor variabilis*
May 31	2	Tennessee Colony		64 *Amblyomma americanum*
June 10	2	Marlin	11 *Pulex irritans*	55 *Amblyomma americanum*
			5 *Ctenocephalides felis*	100 *Heterodoxus spiniger*
October 15	1	Victoria	34 *Pulex irritans*	

domestic and wild rabbit, ground squirrel, bobcat, badger, burrowing owl, rock squirrel, gopher, and prairie dog.

The tick infestation was light. The twenty-four *Amblyomma americanum* taken were all from South Texas. This tick is a proven vector of the rickettsia of spotted fever in this country. Anigstein and Bader (1943) have reported the recovery of a rickettsia-like organism from *Amblyomma americanum* collected at Camp Bullis, Texas, the site of several cases of an apparently new disease designated as Bullis fever.

The fact that Parker and Kohls (1943) have claimed recovery of the infectious agent of American Q fever, *Rickettsia diaporica*, from *Amblyomma americanum* collected in Liberty County, Texas (1935), has assumed additional importance with the recent outbreak of fifty-five human cases of the disease at Amarillo, Texas (Irons *et al.*, 1946).

Eighteen *Dermacentor variabilis* were taken. This tick is a natural vector of spotted fever and tularaemia and is suspected of transmitting bovine anaplasmosis. The sixteen *Amblyomma maculatum*, or cattle ear tick, were from two South Texas coyotes.

Twelve specimens of the spinose ear tick, *Octobius megnini*, one *Amblyomma*

inornatum, and seven *Ixodes cookei* made up the remainder of the collection of ticks. The spinose ear tick is an important economic pest of horses and cattle. In addition to the annoyance caused by its feeding, it makes wounds which become subject to screwworm infestations.

The small series of eight wolves examined showed a somewhat different ectoparasite picture (Table 2). Only two were infested with fleas and the tick population was high. The following ectoparasites were taken: forty-five *Pulex irritans*; fourteen *Echidnophaga gallinacea*; five *Ctenocephalides felis*; one hundred nineteen *Amblyomma americanum*; seven *Dermacentor variabilis*; and one hundred biting lice, *Heterodoxus spiniger*.

In an earlier study of ectoparasites of Lavaca County, Texas (Randolph and Eads, 1946), several wolves were examined. Two species, *Rhopalopsyllus coxi* and *Ixodes scapularis*, were taken in addition to the wolf ectoparasites mentioned above.

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NAMES OF MAMMALS DATED FROM FRISCH, 1775, AND ZIMMERMANN, 1777

By Philip Hershkovitz

Resurgent efforts to date names from the oft discredited Frisch, 1775, and Zimmermann, 1777, must inevitably lead to serious confusion. The nomenclatorial systems employed by Frisch and Zimmermann are non-Linnaean. Their names for mammals are usually ambiguous, the status or hierarchy of each name subject to various and conflicting interpretations. Any apparent uniformity in current citations of the uncitable names of Frisch and Zimmermann is explained by the fact that it is not Frisch, 1775, and Zimmermann, 1777, but Palmer, 1904 (North Amer. Fauna no. 23), and J. A. Allen, 1902 (Bull. Amer. Mus. Nat. Hist., 16: 13–22), respectively, that are quoted. The early dates afforded by the works of Frisch and Zimmermann have been a constant temptation to certain authors confronted with nomenclatorial difficulties. As is shown below, nothing has been gained by the substitution of Frisch and Zimmermann names for well established valid names of later date. Inasmuch as the present Code of Nomenclature proscribes the use of names employed in non-Linnaean systems, no suspension of the Rules for the elimination of the works in question is required. Nevertheless, it is recommended that the International Commission on Zoological Nomenclature declare as unavailable the names contained in the works of Frisch, 1775, and Zimmermann, 1777.

The "Natur-system der vierfüssigen Thiere . . ." published by Frisch in 1775 was carefully scrutinized by Thomas and Miller (Ann. Mag. Nat. Hist., ser. 7, 16: 461–465, 1905). These authors gave examples from Frisch's text, listed the names he applied to genera, and concluded (p. 463) that Frisch's "system of naming is hopelessly non-Linnaean. What Frisch apparently intended to do was merely to supply his pupils with Latin equivalents for German vernacular terms; but of the essential principles of binomial nomenclature he had not the least idea. [Footnote, *loc. cit.*] Or, if he had any clear notion of it, he deliberately rejected the system. . . . [Footnote, *loc. cit.*] No one has suggested that the specific names are valid, and, in fact, their status is too evident to require any discussion."

The above analysis was made in protest to Palmer's inadvertent recognition of some of Frisch's names in the "Index Generum Mammalium" (North Amer. Fauna no. 23, 1904).

For a period of time, Frisch's names were not used. They are excluded from Miller's "List of Recent North American Mammals, 1923" (U. S. Nat. Mus., Bull. no. 128, 1924) and from G. M. Allen's "A Check list of African Mammals" (Bull. Mus. Comp. Zool., 83, 1939). Recently, however, certain authors have been finding it convenient to employ some of the Frisch names listed by Palmer. These authors have not shown that Thomas and Miller erred in their judgement of Frisch's system of nomenclature and they are not aware of a number of discrepancies between Palmer's versions of the names they cite and the appearance of these names as originally proposed by Frisch.

Palmer listed forty-nine generic names dated from Frisch, 1775. Twenty of

these appear as antedated, preoccupied, unidentifiable or otherwise invalidated, and need no further discussion. The remaining twenty-nine (including a split binominal) generic names are subject to acceptance by the unwary and are here listed and discussed. The Frisch names *ex* Palmer in bold face type are followed by their valid equivalents in parentheses. References marked by an asterisk appear in the "Official List of Generic Names," Opinion 91, International Commission of Zoological Nomenclature (Smithsonia Misc. Coll., 73, no. 4, 1926).

Alce (= *Alces* Gray, 1821*).

Asinus (= *Asinus* Gray, 1824; currently treated as a subgenus of *Equus* Linnaeus).

Babirussa (= *Babirussa* Lesson, 1827).

Bubalis (= *Alcelaphus* Blainville, 1816).

Bubalus (= *Bubalus* H. Smith, 1827). Simpson (Bull. Amer. Mus. Nat. Hist., 85: 158, footnote 3, 1945) remarked that "Frisch's two names *Bubalis* and *Bubalus*, published simultaneously, refer to two different animals, the hartebeest and the Asiatic buffalo. Their similarity has given rise to endless confusion. They can probably be discarded as not binomial[!]." Unfortunately, Simpson, in his classification of the mammals (*op. cit.*) followed no consistent policy in his treatment of Frisch's names. Some Frisch names (*ex* Palmer, to be sure) were "discarded" or "conveniently dropped" by Simpson, others were ignored completely or recognized provisionally, and still others were adopted without qualifications. As shown by Thomas and Miller (*supra cit.*), there are legitimate reasons of weight for rejecting all of Frisch's names. Simpson, however, was evidently not acquainted with the "Natur-system der vierfüssigen Thiere" and he rejected only those names he believed to be "not binomial." Perhaps it is believed that Article 2 of the International Code should read: "The scientific designation of animals is [*binominal*, instead of] uninominal for subgenera and all higher groups."

Buselaphus (= *Bubalis* Frisch = *Alcelaphus* Blainville, 1816).

Capreolus (= *Capreolus* Gray, 1821).

Coati (= *Nasua* Storr, 1780*). Happily, "*Coati* Frisch" *ex* Palmer, appears to have escaped the attention of other authors.

Dama (= *Dama* H. Smith, 1827, preoccupied by *Dama* Zimmermann, 1780, and replaced by *Platyceros* Zimmermann, 1780).

Gacella (= *Gazella* Blainville, 1816). "*Gacella* Frisch" *ex* Palmer, overlooked by other authors. Palmer listed this name in Part III of the "Index Generum Mammalium" (pp. 917, 953) and not in the alphabetically arranged Part I.

Gulo (= *Gulo* Pallas, 1780*).

Lama (= *Lama* Cuvier, [1800] 1805). Palmer (*op. cit.*: 363) listed "*Lama* Frisch" simply as "based on 'das americanische Kameel'." Frisch referred the following to his *Lama*: "Das lama oder Glama," "das Huana celama," "das Guanaco," "Das Pacos oder Alpaque," "das zahme Pacollama," and "das wilde Vicujna." Simpson (Bull. Amer. Mus. Nat. Hist., 85: 150, 1945) replaced the preoccupied *Auchenia* Illiger, 1811, with "*Lama* Frisch" and noted (*op. cit.*: 150, footnote 4) that the former "is still occasionally used by careless authors."

Leo (= *Leo* Brehm, 1829). Except for Palmer, authors do not date *Leo* from Frisch.

Linx (= *Lynx* Kerr, 1792*). No one has attempted to replace *Lynx* Kerr with "*Linx* Frisch."

Macrocephalus (= *Phacochaerus* Cuvier, 1819 = *Aper* Pallas, 1766). Frisch's name (*ex* Palmer) has not been adopted.

Marmota (= *Marmota* Blumenbach, 1779).

Martes (= *Martes* Pinel, 1792).

Panthera (= *Leo* Brehm, 1829). Current usage of *Panthera* as a generic name for the lions, tigers, and leopards is enigmatic. The unavailable "*Panthera* Oken, 1816," cited by certain authors is antedated by the equally unavailable "*Panthera* Frisch." Authors would be wise to cite correctly the original source for "*Panthera* Oken," (*viz.*, Allen, Bull. Amer.

Mus. Nat. Hist., 16: 377–78, 1902). Oken did not propose *Panthera* as a technical name, certainly not as a generic name. He employed (Lehrbuch, Naturg., Theil 3, Abt. 2: 1058, 1816) the names "Panther," "Panthère," etc. as the vernacular, and "Panthera" and "Pardus" as the pre-Linnaean classical synonyms for his [*Felis*] *P*[*ardalis*] *vulgaris* (= *Felis pardus* Linnaeus).

Papio (= *Papio* Erxleben, 1777).

Pavianes (= *Papio* Erxleben, 1777). Frisch, 1775, gave the binominal "*Papio, Pavianes*" for the baboons. Palmer listed each name separately.

Putorius (= *Putorius* Cuvier, 1817*).

Rangifer (= *Rangifer* H. Smith, 1827*).

Rattus (= *Rattus* Fischer, 1803). Simpson (*op. cit.*: 89) provisionally recognized "*Rattus* Frisch." He remarked (footnote 3, *loc. cit.*) that "*Rattus* was used more or less in the present sense by Frisch in 1775 and by Zimmerman in 1777, but it is uncertain whether either of these should be considered valid. . . . Most recent authors, however, consider that *Rattus* as applied to the true common rats can be dated at least from Fischer in 1803 if not from Frisch, and hence is valid."

Rupicapra (= *Rupicapra* Blainville, 1816*).

Strepsiceros (= *Strepsiceros* H. Smith, 1827). Simpson's (*op. cit.*: 158, footnote 1) recognition of "*Strepsiceros* Frisch" is qualified by the statement that "this name is subject to some question, but even if Frisch's date be refused, it was correctly used by Rafinesque in 1815." Rafinesque's name is a *nomen nudum* and not available.

Tagassu (= *Pecari* Reichenbach, 1835). Tate (Bull. Amer. Mus. Nat. Hist., 76: 223, 1939) employed "*Tagassu* Frisch" for the collared peccaries. He noted that the similarity of the names *Tagassu* and *Tayassu* Fischer, for the white-lipped peccaries, created a "slightly absurd condition." Tate resolved the absurdity by declaring *Tayassu* a synonym of *Tagassu*! Simpson (*op. cit.*) ignored Frisch's name for the peccaries.

Tamandua (= *Tamandua* Gray, 1825). Frisch listed the following as species of *Tamandua*: "Tamandua guacu" (= *Myrmecophaga*), "Tamandua I." (= *Tamandua* of authors), "Tamandua urivau" (= *Cyclopes*), and "Tamandua minima" (= *Cyclopes*). Trouessart (Suppl. Cat. Mamm.: 803, 1904) recognized "*Tamandua* Frisch" and listed "*guacu et urivau* Frisch" as synonyms of *Tamandua tetradactyla* Linnaeus, the only species recognized. As neither the "guacu" nor the "urivau" of Frisch are equivalent to *tetradactyla* Linnaeus, the name *Tamandua* Frisch cannot be applied to the four-toed anteater. Tate (Bull. Amer. Nat. Hist., 76: 170, 1939) insisted on following "the general [!] usage of *Tamandua* Frisch for the *tetradactyla* anteater." He (*op. cit.*: 170) even designated *Myrmecophaga tetradactyla* the genotype, a name not included in the *Tamandua* of Frisch. Miller (U. S. Nat. Mus. Bull. 128: 501, footnote 18, 1924) correctly stated that the "generic name *Tamandua* is not available either from Frisch 1775, Rafinesque 1815, or Gray 1821."

Tigris (= *Tigris* Gray, 1843 = *Leo* Brehm, 1829). The tigers, lions, and leopards are regarded as congeneric by virtually all authors and the name *Leo* Brehm is the earliest valid name that applies.

Vulpes (= *Vulpes* Fleming, Philosophy of Zoology, Edinburgh, 2: 184, 1822). *Vulpes* Brisson, 1762, and *Vulpes* Oken, 1816, are not available (*cf.* Allen, Bull. Amer. Mus. Nat. Hist., 16: 377, 1902). *Vulpes* Skjöldebrand, 1777, is a *nomen inquirendum*. *Vulpes* Oken (Lehrbuch: 1032, 1816) currently cited, incorrectly, as the generic name of the common fox, is primarily the fennec, "*Vulpes minimus Zaarensis*" Skjöldebrand, the only species included by Oken in his "Gattung *Megalotis*" (= *Fennecus* Desmarest). Oken's subsequent employment (*op. cit.*: 1032–1034) of "*Vulpes*" for the foxes is as a mononomial specific name within the "Gattung *Canis*" hence not available even if Oken's names were allowed. A valid proposal of *Vulpes* dated prior to Fleming, 1822, may be found. In any case, it is highly desirable, if not almost mandatory, to retain the generic name *Vulpes* for the common fox.

The valid generic names listed above (in parentheses) are the familiar ones. They are, of course, subject to the Law of Priority. The publications wherein

each of these names first appeared are found in the cited works of Palmer, Miller, and G. M. Allen. It will be noted that of the twenty-nine Frisch names discussed above, nineteen are identical with those dated from later authors; three names (*Alce*, *Gacella*, *Linx*) are nearly identical with names dated from later authors. Only one of these, *Alce* (= *Alces* Gray) has appeared in recent literature. Of the remaining seven Frisch names, *Coati*, *Bubalis*, *Bugelaphus*, *Macrocephalus*, *Panthera*, *Pavianes*, and *Tagassu*, only the last has been used in one or two recent works. Evidently, not one of the universally familiar generic names is affected by the suppression of Frisch's names. On the other hand, many well established generic names would fall by the wayside if it were somehow possible to distort all present concepts of systematics and accept Frisch's names.

The "Specimen Zoologiae Geographicae," by E. A. W. Zimmermann, published in Leiden, 1777, was analyzed by J. A. Allen (Bull. Amer. Mus. Nat. Hist., 16: 13–22, 1902). Allen concluded that the specific and generic names proposed by Zimmermann are valid under the Code and must be adopted where priority is indicated. Contemporary authors responded unfavorably to Allen's opinion (*cf.* Allen, *op. cit.:* 161). Oldfield Thomas (Novit. Zool., 9: 136, 1902) did accept one of the Zimmermann names championed by Allen, *viz.*, *Dama*. As Thomas gave no explanation for his use of this generic name for the Virginia Deer, it cannot be determined whether he intended to date *Dama* Zimmermann from the controversial opus of 1777, or from Zimmermann's acceptable "Geographische Geschichte" of 1780. Strong opposition to the use of the names proposed by Zimmermann in 1777 was sharply expressed by Miller (Proc. Biol. Soc. Washington, 15: 39, 1902). Miller aimed his criticism mainly against the adoption of the generic name *Dama* Zimmermann, 1777, but his objections applied equally to all of Zimmermann's names.

In his analysis of Zimmermann, 1777, Allen (*op. cit.*, p. 13) admitted that, regarding nomenclatorial form, Zimmermann, 1777, "was not a model, even for his day . . . [and] although binomial [!] as regard technical names, often employed vernacular names only, for genera as well as species, even when defining them by a formal diagnosis; while in the case of species he was apt to cite the names given by previous writers as these authors used them, regardless of whether the generic element of the name conformed or not with his own genera." To overcome difficulties in interpreting the status of names mentioned in the text, Allen suggested (p. 15) that "in deciding what names are to be construed in a vernacular sense and what in a technical sense, in the case of the 'Zoologiae' great aid is rendered by Zimmermann's index to the work . . . [and] further aid is furnished by the key to his map." Allen then culled a list of thirty-three new specific names to be credited to Zimmermann. Of these names, seven were indicated as the earlist available for the animals concerned.

In the following examples of Zimmermann's system, three of the seven new Zimmermann names regarded as available by Allen appear in the parts of the text cited. The names are "*Dama Virginiana*," "*Cervus porcinus*," and "*Lutra Brasiliensis*."

On page 351 of Zimmermann, 1777, the *Dama virginiana* quoted by Allen is

mentioned in the plural ("*damae virginianae*") and discussed under the heading "*Cervus dama.*" On pages 531–34, Zimmermann enumerated the following species under genus "III. *Cervus.* Linn."

[P. 531] "1.) *Alce.* Linn. . . .
"2.) *Tarandus* Linn. . . .
"3.) *Dama* Linn. . . .
[P. 532] "4.) *Cervus Elaphus* Linn. . . .
"5.) *Cervus Axis. l'Axis Buffon.* . . .
"6.) *Cervus porcinus.* Porcine Deer. Pennant. . . .
"7.) *Dama Virginiana.* Virginia Deer. Pennant. . . .
[P. 533] "8.) *Cervus Capreolus.* Vid. Cap. I.
"9.) *Cervus Pygargus.* Pallas. . . .
"10.) *Cervus* (vel potius) *Capreolus mexicanus.* Mexican Deer. Pennant. . . .
"11.) *Cervus camelopardus.* Linn. . . ."

On pages 484–485, Zimmermann enumerated the following species under genus "V. *Mustela.* Linnaeus."

"1.) *Lutris.* Lutram marinam vide in Capite Secundo.
"2.) *Lutra Brasiliensis.* Saricovienne. Buffon. . . .
"3.) *Lutra.* Vid. Caput Secundum.
"4.) *Lutreola.* ibidem.
"5.) *Gulo.* ibid.
"6.) *Martes.* ibidem." (followed by others to the number of 18)

The above examples are sufficient to illustrate the lack of consistency in the arrangement of names and the difficulty, if not impossibility, in some instances, of arriving at any agreement as to which names are generic, which specific (or subspecific), which are proposed as new names, and which are merely quoted from previous authors. Miller (*op. cit.*) has given more examples of the same sort. In fact, the whole of the systematic part of Zimmermann, 1777, shows the same inconsistent structure. Furthermore, these examples from the text show that certain names can be cited by different authors in different ways and can be made to refer to different hierarchies and to different animals. Thus, "*Dama Virginiana,*" as listed by Zimmermann, might be cited as [*Cervus*] *dama virginiana* with only *virginiana* regarded as new (subspecies?) because the species *Cervus dama* is also listed by Zimmermann. It might also be cited as either *Cervus* (*Dama*) *virginiana*, new subgenus and species, or, as was done by Allen, *Dama virginiana*, genus and species new. Similar permutations can be made of many other names enumerated by Zimmermann under generic headings. Zimmermann's use of the Linnaean name *putorius* affords an example of a different type of confusion. This name appears under genus "IV. *Viverra,*" first (p. 481) as species "5.) *Putorius capensis,*" and then (p. 483) as species "9.) *Viverra putorius.*" Under genus "V. *Mustela,*" it reappears (p. 485) as species "7.) *Mustela Putorius.*"

Just as in the case of Frisch, 1775, it cannot be argued that because of names already current, greater confusion than uniformity might arise from the suppression of Zimmermann, 1777. Of the seven new specific names declared available

by Allen, one, *Yerboa* [*sic*] *gigantea* is of even date with *Jaculus giganteus* Erxleben and is universally credited to the latter author. Another name, *Cervus* (vel potius) *Capreolus mexicanus* was declared unidentifiable by Allen (*op. cit.*: 17, footnote) and is not in current use. *Mus oeconomus* is currently credited to either Zimmermann, 1777, or to Pallas, 1778. The remaining five names, *Dama virginiana*, *Bos gnou*, *Lutra brasiliensis*, *Mustela javanica*, and *Cervus porcinus*, are correctly proposed in Zimmermann's "Geographische Geschichte," 1780, and are available from that date. Thus, the elimination of Zimmermann, 1777, involves one change in author, five changes in date, and no changes in technical names.

Chicago Natural History Museum, Chicago, Illinois. Received January 27, 1948.

THE GENITAL TRACT OF THE MALE CONGA HUTIA, *CAPROMYS PILORIDES (SAY)*

By Juan J. Angulo and Miguel T. Alvarez

The conga hutia, *Capromys pilorides* (Say), is a rodent native to Cuba and adjacent keys. It belongs to the family *Capromyidae* (Tate, 1935). Two subspecies exist, *C. p. pilorides* and *C. p. relictus*; the latter from Isle of Pines. The animals studied here belong to the first subspecies, which inhabits the island of Cuba.

Other species of the same genus are: *C. prehensilis* Poepigg, *C. melanurus* Peters, and *C. nana* Allen. These are commonly known as carabalí hutia, andaraz hutia, and enana hutia, respectively. Several species of other genera of the same family are found in Jamaica, Santo Domingo, Bahamas, and Venezuela. The conga hutia is easily obtainable as it is abundant in certain regions of Cuba. Adult males have an average weight of 3 kg., though very well developed specimens may reach 5 kg. or more. In this paper, the anatomical findings in the male reproductive tract of the adult conga hutia are presented. Unless otherwise specifically stated, the number of fresh specimens upon which these results were obtained was sixteen. There are no references in the literature on the male genital tract of species of the genus *Capromys*.

Testis.—The testis has an oval form (Fig. 1) with its long axis parallel to that of the body. It is decidedly more elongated than that of the guinea pig. The surface is covered by the tunica vaginalis which, on reaching the dorsal border of the testis, forms the meso-epididymis. In the caudal pole of the testis, the gubernaculum is inserted and the dorso-caudal portion is in relation at the same time with the gubernaculum and epididymis, both covered by the tunica vaginalis. The hilus of the testis is found on the dorsal border at the level of the middle of that organ; the cephalic portion of the dorsal border of the testis contacts the fat contained in the meso-epididymis, at this level very abundant. The testis is pinkish white, the vascularization being prominent beneath the albuginea. Consistency is soft upon cutting and, on separation of the albuginea, the parenchyma herniates easily.

In the supine cadaver, the testes are frequently found immediately dorsad and cephalad to the pubis, about 2 cm. from the midline, floating in the peritoneal cavity and adhering to the apex of the collapsed cremasters by gubernacula 20

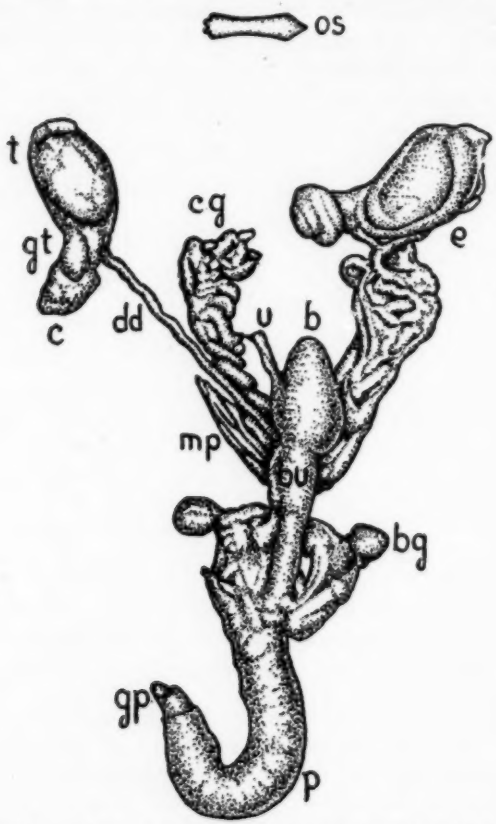

FIG. 1—Genital tract of a male conga hutia, × ½. On the right half, the mesorchium has been dissected off. The glans penis is partially covered. b, bladder; bg, bulbourethral gland; bu, bulbar urethra; c, a portion of the cremaster; cc, cremaster; cg, coagulating gland; dd, ductus deferens; e, epididymis; gp, glans penis; gt, gubernaculum testis; im, ischiatic muscles; mp, prostate middle lobe; os, os penis; p, penis; r, caudal end of the rectus abdominis muscle; t, testis; u, ureter, distal end.

mm. long. In the specimens studied, the average weight of the testis was 3 grams and the average dimensions of that organ were about 25 mm. in length, 17 mm. in width, and 10 mm. in depth. The testicles of the conga hutia are neither pendent, as in the rabbit and dog, nor protruding as in the rat and mouse. Besides, they cannot be seen from behind, as is the case with the guinea pig, even

by lifting the tail. There is a rudimentary scrotum; the skin at its level is not macroscopically differentiated and the testes are merely bulging. The position of the testes, examined many times in more than 100 specimens, was always inguinal.

The testes in this species are found in the rudimentary scrotum throughout the year. This contention results from observations on twelve groups of males totaling forty-eight specimens. Every month of the year, several males recently captured in the neighborhood of Ceiba Mocha were examined for testes position two or more times a day for a few days. To facilitate the observation of the position of the testes, the abdominal skin was shaved in an ample zone around the penis and the anus. The vertical, standing attitude was the only one adequate for observation; this attitude being normal in the hutia when feeding or attacked. A T-shaped stick was used for compelling the animals to stand up. To avoid frightening the hutias, no sudden movements were made by the operator.

Epididymis.—The epididymis (Fig. 1) is an elongated, laterally flattened body in its cephalo-caudal aspect. It adheres to its corresponding testis by a caudal portion. The cephalic portion is found in the edge of the mesorchium and the dorsal edge of the epididymis contacts the mesorchium fat. The epididymis adheres firmly to the testis only at a small portion of the dorsal and caudal aspect of the latter. The remainder of the epididymis is contained between the two leaves of the mesorchium.

As in other animals, three portions may be distinguished in the hutia's epididymis: the head, anterior; the tail, posterior; and between them, the body. In four specimens, the length of the coiled mass of the epididymis ranged from 25 to 40 mm., its width at the body from 5 to 7 mm., and its thickness at the body from 2 to 5 mm. Consistency is soft and the color pink to purplish pink, vascularization is slightly marked.

Ductus deferens.—The ductus deferens (Fig. 1 and Pl. I, left) is contained in a free fold of the mesorchium and is uniformly cylindrical, about 2 mm. in diameter; its length varied from 110 to 150 mm. It curves cephalad, first following a concave path, then reaching the pelvic brim; it then goes caudad and is placed between the prostate and the bladder, dorsal to the latter organ (Pl. I, left), and opens into the urethra at the level of a very well-developed verumontanum.

The terminal portion of the ductus deferens runs along with the excretory duct of the coagulating gland of the same side, but ventral to it, between the bladder and the mentioned excretory duct.

Prostate.—According to the terminology used by Moore (1939), in the conga hutia's prostate two parts may be noted: the middle lobe and the coagulating glands. The former may be called the intermediate lobe according to Engle (1926) and the dorso-lateral lobe according to Callow and Deanesly (1935); the latter might be named the anterior lobe following Moore, Price, and Gallagher (1930), the proximal lobe according to Engle, and the cranial portion according to Callow and Deanesly.

The middle lobe is a well-differentiated structure, covered by a thin enveloping fascia through which the glands that make the middle lobe are easily seen. It

surrounds the bladder laterally and dorsally as well as the urethra (Pl. I, left). The ventral aspect of the bladder neck is free of prostatic tissue and runs into the urethra; thus, there is no ventral lobe of the prostate, which is well developed in the rat (Moore, 1939) and present in man, though rudimentary in general. The middle lobe encircles the caudal ends of the coagulating glands and may be easily separated, by dissection, from them and from the bladder. The middle lobe acini are found coiled in the interior of the fine lobular capsule, having a general caudad direction. By the fusion of several of them, they constitute ducts.

The coagulating glands are paired organs (Fig. 1 and Pl. I, left) enclosed in the mesorchium and adjoining the ductus deferens. They have been so classified because: (1) There is a coagulum at the meatus urinarius after electric stimulation of the brain, with the technique for experimental ejaculation in the guinea pig (Moore and Gallagher, 1930), also, a spontaneously formed coagulum was found in a dead hutia. (2) The gross structure of the glands described, as well as their position in relation to the bladder and prostate middle lobe, reproduces those of the coagulating glands of the rat, mouse, and guinea pig. (3) Their content coagulates, in vitro, the middle lobe secretion in the same way as that of the guinea pig's vesicular glands. This non-specificity of the hutia coagulating glands is similar to that found by Camus and Gley (1896, 1922) in the secretion of the coagulating glands of Brazilian rodents and the rat when put in contact with the content of the guinea pig vesicular glands. The above experiments were performed with the same results in five specimens with due precautions to avoid contamination of one secretion with the other at the time of removing the glands; as recommended by Engle (1926), no dilution in saline solution was used; also his Petri dish technique was employed. As controls, each one of the secretions alone was used, no change being noticed.

In relation to the above classification, it must be remembered that to Engle (1926), Callow and Deanesly (1935), and Price (1936, 1939) the coagulating glands constitute a lobe of the prostate; they base their belief on embryological studies in the rat, guinea pig, and mouse which showed identical origin for both glands—the coagulating glands and the other lobes of the prostate. To Walker (1910a, 1910b), the coagulating glands are glands apart, possessing physiological and anatomical differences.

We have not been able to make embryological studies in the hutia; the same is true with most of the species bearing the gland referred to. At their first dissections of hutias, the authors thought about the possibility of the coagulating glands being seminal vesicles; but soon they accumulated sufficient data to eliminate this hypothesis, the data being the following: (1) The coagulating glands of the conga hutia do not have saccular form like the human or rat vesicular glands. (2) A single coagulating gland is a replica, but on a large scale, of a prostatic lobe of the same species, or of the guinea pig, rat, or mouse, and consequently is also macroscopically identical to a coagulating gland of the three last-mentioned species. (3) Injections of a methylene blue solution either in one of the described glands' excretory ducts or in one of the ducti deferens demonstrated an anatomical independence between them, which was checked by a dis-

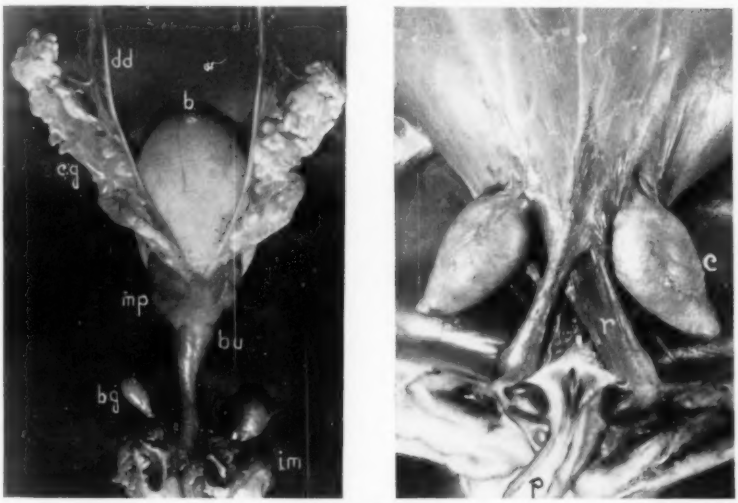

PLATE I

LEFT: Prostate, dorsal aspect, × ⅔
RIGHT: Caudal portion of the ventral abdominal wall, × ⅔. The cremaster is distended by the testicle; not always found so. Note the decussation of the two superficial bundles of the rectus abdominis muscle

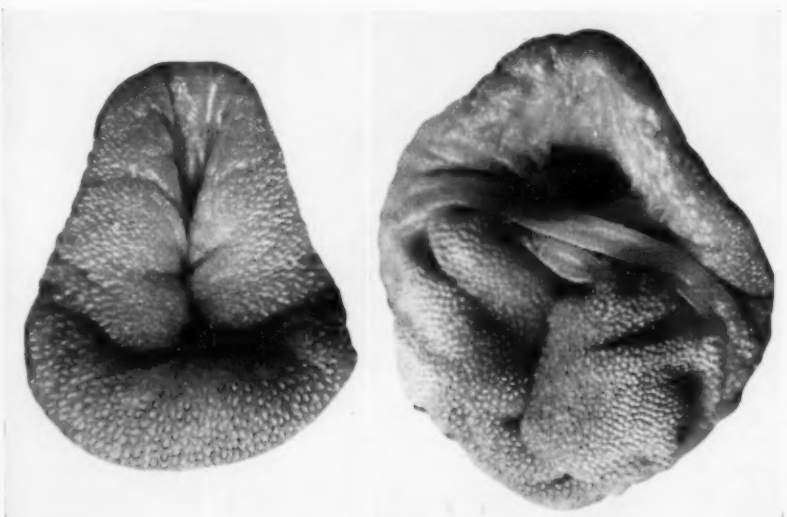

PLATE II

LEFT: Distal end of the penis, ventral aspect, × 7½
RIGHT: Distal end of the penis, ventral aspect. The mucosa has been distended, × 7½

section of both ducts showing that they only join at the verumontanum. This independence, the absence of ampullary glands and of spermatozoa in the content of the studied glands in cadavers of hutias, led to the conclusion that there is no homologue of the human vesicular glands in the conga hutia. (4) The presence of a semen-coagulating substance, in the content of the hutia's gland referred to, finally eliminated the homology with the guinea pig and rat vesicular glands.

After freeing a coagulating gland of the connective tissue in which it is embedded, there is seen a large, long tube into which many smaller ones open. The latter are either plain or formed by the fusion of two or more coiled thinner tubes. About 2.5 cm. before reaching the middle lobe, as well as inside it, the main duct presents no collateral tubes. This duct ends at the dorsal wall of the prostatic portion of the urethra. The gland content is a whitish gray secretion, somewhat less viscous than that of the guinea pig vesicular glands.

Bulbourethral glands.—The bulbourethral glands are well developed, being actually larger than those of man. The dimensions of one gland in five specimens were, respectively, 12, 9, 11, 11, and 10 millimeters in length; 7, 8, 9, 9, and 6 mm. in width; 4, 5, 5, 5, and 4 mm. in thickness; and 190, 237, 300, 290, and 180 milligrams in weight.

The hutia Cowper's glands are two reniform bodies, one on each side of the midline very near the origin of the crura penis (Fig. 1 and Pl. I, left), and as in man they are located between the two layers of the fascia of the urogenital diaphragm. They have elastic consistency and they are reddish yellow. Each gland has an excretory duct, which was 20, 25, 24, and 25 millimeters long, respectively, in the first four mentioned specimens. The duct starts in a depression at the center of the internal edge of the organ and opens, as in man, into the bulbar urethra.

Penis.—The penis is cylindrical, ending in a blunt cone corresponding to the prepuce. Its skin is highly pigmented, almost black at the prepuce; the remainder of the penile skin is similar in color to the abdominal skin at its level, although slightly more pigmented.

Two portions may be considered in the penis: one proximal, adherent, comprises crura and corpora cavernosa; the other, distal, free, comprising shaft and glans, is covered by the prepuce. The proximal portion begins in the perineum, between the superficial and deep fasciae, originating in two crura penis adherent to the ischia. The crura join and then the corpora cavernosa, along with the cavernous urethra, constitute the penis itself which, at the level of the symphysis pubis, curves and acquires a cutaneous cover, becoming then the distal free portion of the penis.

The distal portion, which leaves the abdomen immediately above the symphysis pubis, is elongated with a dorsal and ventral bulge, but is laterally flattened. Its length under actual conditions, covered thus by the prepuce, varied in the specimens studied from 4 to 6 cm.; its diameter was about 1 cm. at the shaft. One observation of the penis in erection showed the free portion reaching 10 cm. in length. The glans penis ends in a sharp point, smooth dorsally—ventrally it widens. The meatus urinarius (Pl. II, right) is found immedi-

ately below the point, ventrally, and is located at the central end of a slit (Pl. II, left) having the shape of an inverted T. If slight pressure is made caudadwards on the ventral face of the glans, this slit opens and a cul-de-sac, irregular in shape, with numerous folds is seen. If pressure is increased, two culs-de-sac are observed; one of them, sub-urethral, is on the dorsal half and is separated from the meatus by a flexible ridge. The second cul-de-sac is situated on the ventral half, at the corona glandis. The folds are formed by the glans itself, not by the prepuce.

The whole glans penis is covered with multiple papillary projections, similar to small horns or spines, visible to the naked eye. They are missing only around the meatus, at the above-mentioned dorsal cul-de-sac, and between the prominences of the corona glandis (Pl. II, right). Under the mucosa of the dorsal aspect of the glans, a bony plaque is found, shaped like a primitive arrowhead, concave in its ventral portion, thin, and showing two small prominences at its proximal end (Fig. 1). This os penis measured in four specimens 17.5, 18, 20, and 22 mm. in length and 5, 6, 5, and 6 mm. at its greatest width, respectively. The depth at different points varies considerably in the same specimen due to its shape.

The suspensory ligament is scarcely developed. The prepuce is well developed and easily permits the exposure of the glans penis; its cutaneous portion is heavily pigmented while its mucosal portion contacts the glans. It does not offer special characteristics except for the fact that its insertion is well behind, one cm. behind the corona glandis.

Covering and enclosing structures: Cremaster.—The cremaster muscle (Pl. I, right) hangs from the inguinal ring as a cloth percolator or colander from its metal ring. It has a base, an apex, and two slightly flattened faces with two borders. The base inserts at the inguinal ring, the apex is practically free in the loose tissue of the groin below the superficial fascia, and the internal border is oblique caudad and outward, adjoining the rectus abdominis muscle sheath. The external border, also oblique, lies on the insertion fascia of the external oblique muscle in the pubis. The ventral face contacts the loose tissue under the superficial fascia; the dorsal face contacts the parietal peritoneum, the sheath of the rectus abdominis muscle, and the muscles of the groin.

The arciform fibers of the cremaster muscle cover a sac of peritoneum. At its vertex and on the inner surface, the gubernaculum testis of the same side is inserted. The arciform fibers are compact, sufficiently so to give the impression of a muscular sac in its ventral face and its borders; the fibers thin out dorsally allowing the peritoneal layer to be seen.

In the conga hutia there is only one inguinal ring on each side of the body; each testis, not the spermatic cord, passes through the corresponding ring to the scrotal cavity. The elements of the cord are abdominal. The center of the inguinal ring is about 2 cm. outside of the midline and approximately at the same level as the angle of curvature of the penis. Once skin and superficial fascia are cut at about the inguinal ring, the thin fascia of the external oblique muscle, which is also thin as in other rodents, is found. Then, the cremaster, which is

loosely attached to the external oblique muscle, comes to view. Immediately below, there is a thin, crescent-shaped fascia with the internal oblique muscle inserted on its external border; then, the transversus abdominis muscle is found. The peritoneal lining of the scrotal cavity and the arciform fibers of the cremaster have their insertions on the internal border of the above-mentioned crescent-shaped fascia. This fascia constitutes the externo-caudal half of the inguinal ring. The externo-cephalic half of this ring is formed by the adherence of the peritoneum to the sheath of the rectus abdominis muscle. The opening of the scrotal cavity is made directly to the parietal peritoneum by a slight thickening of the parietal peritoneum at this level, in the shape of a ring that has the double role of internal and external ring and through which the testes go in and out freely, as said before.

The caudal end of the rectus abdominis muscle consists of three bundles which decussate and interlace (Pl. I, right) with the corresponding bundles of the other rectus abdominis muscle. This decussation and interlacing was noticed in all the specimens as well as in twenty-five other specimens of both sexes. There is a marked difference in thickness of the bundles. The middle bundle is most developed while the bundle closest to the peritoneum is least developed and is even sometimes missing in one of the recti.

Mesorchium.—The mesorchium is constituted by an ample peritoneal fold, dependency of the parietal peritoneum, which starts in the region of the corresponding kidney and goes caudad following the general direction of the psoas major muscle, in the shape of a right triangle of free hypotenuse. The major cathetus of this triangle corresponds to the insertion of the mesorchium on the dorsal wall of the abdomen. The free hypotenuse is infiltrated with fat, like an omentum, with finger-like prolongations of long edges four to five in number, and these fatty appendices reach a length of 5 to 10 cm. in the neighborhood of the testicle. The cathetus minor of the above-mentioned triangle is occupied in succession by the gubernaculum, the testis, and the infiltration of fat constituting the fatty appendices already mentioned.

The mesorchium gives a fold to the corresponding coagulating gland. There is also a second fold in the free edge of which the terminal portion of one of the ducti deferens is found.

The external surface of the mesorchium is continuous with the dorsal parietal peritoneum; the internal or middle face (second leaf) gives the folds already mentioned and going caudad and mediad is continuous dorsally with the pre-rectal peritoneum and ventrally with the retro-vesical peritoneum. In its base, the ureter and spermatic artery and vein are found, and in the dorsal and internal aspect, the deferential artery is seen.

The blood supply of the mesorchium is given by the spermatic artery and deferential artery, as in man; likewise, the right spermatic vein goes directly to the cava vein, while the left spermatic vein goes to the left renal vein.

Summary.—1. Anatomical findings in the genital tract of sixteen adult male specimens of conga hutia, *Capromys pilorides* (Say), are described.

2. Inguinal testes are found in a rudimentary scrotum throughout the year.

3. There are no vesicular glands nor prostate ventral lobe.

4. The prostate consists of the middle lobe and the coagulating glands. The secretion of the latter coagulated in vitro the secretion of the former as well as the secretion of the guinea pig vesicular glands in each one of the five specimens tested. A coagulum at the meatus urinarius was also found after experimental ejaculation in several hutias and in one time it was spontaneously formed.

5. The penis, which in erection is about 10 cm. long, has an os penis and its mucosa is covered with spines.

6. Besides the remaining organs, the cremaster and mesorchium are also described.

7. The decussation and interlacing of the bundles constituting the caudal end of the rectus abdominis muscles were noticed in all the specimens as well as in twenty-five other specimens of both sexes.

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A NEW EASTERN MARSH-INHABITING RACE OF RACCOON

By Herbert L. Dozier

Studies of the raccoon as a predator on the muskrat has resulted in the discovery that the marsh-inhabiting raccoon of the Eastern Shore tidewater section of Delaware, Maryland, and Virginia represents a distinct new race. This coastal form is locally known by the common name of "marsh coon" and at times occurs in great abundance. Most local marsh owners and coon hunters are of the opinion that this animal is a serious enemy of the muskrat, secondary in importance, in this section, only to the red fox. On the other hand the so-called "woods or swamp coon" (typical *Procyon l. lotor*), which inhabits the more upland or adjacent ridge areas over the same territory, is rarely found on the marsh itself and appears insignificant in its relation to marsh management.

Procyon lotor maritimus, subsp. nov.

Coastal Marsh Raccoon

Type.—Adult female, skin and skull, no. 275290, U. S. National Museum (Biological Surveys Collection); collected December 3, 1946, by Herbert L. Dozier on the Blackwater National Wildlife Refuge, Dorchester County, Maryland. Weight, 11.2 pounds in flesh.

Distribution.—Known only from marsh areas on the Delmarva Peninsula (Delaware, Maryland, and Virginia).

General characters.—A small to medium, pale subspecies. Readily distinguished from typical *Procyon l. lotor* by its paler coloration; longer but more sparse guard hairs; much smaller size; more slender legs and general build; narrower and more pointed head; decidedly shorter, more pointed, and less prominently banded tail; and relatively much shorter caudal vertebrae. In general color and length of the subapical band of the guard hair it is perhaps nearest to *Procyon l. mexicanus* of Arizona, New Mexico, and Mexico, but is only about half the size of the latter and its tail is decidedly shorter and less distinctly marked.

Color.—Upper portion in general pale buffy grayish, becoming light ochraceous buffy on shoulders, with rufous tinge on nape; the longer, black-tipped guard hairs over the median dorsal area are grouped on the back as unevenly colored streaks, somewhat undulating or serpentine in arrangement (in marked contrast to the darker general salt and pepper effect of typical *Procyon l. lotor*); light-colored subapical band of each guard hair extends a greater distance beyond the underfur tips than in *lotor* and results in a much paler or more yellowish cast to the outer pelage; guard hairs almost entirely white along the sides and lower parts, adding to the pale, shaggy general appearance of the animal; top of head a light grizzled mixture of gray and brownish-black; facial mask brownish-black and decidedly less prominent than in *lotor;* feet black, with gray hair dorsally, the claws dull black (description from live and freshly killed animals); tail with five, rather narrow, brownish-black rings and a black tip, alternating with wider light ochraceous buffy rings, less clearly defined below (Pl. I).

Pelage.—An uneven spread of hair with respect to average guard hair length is apparent, that of the mid-dorsal area being in general slightly shorter than in the rest of the pelt, due probably both to sparser distribution of hair and to variation in fiber length. The very long, coarse guard hair is typical of this race and unique among eastern races of raccoons. Due to the length and sparseness of the guard hairs, coupled with possible decreased density of the underfur, there is a slight backward slant to the direction of the hair flow. In *lotor* the hair is more dense, shorter, erect, and more fluffy in appearance than in *maritimus*.

Skull.—Of medium size, (Table 1) rather narrow and elongate. Compared with that of *lotor*, the skull is slightly smaller, less heavily built, distinctly narrower, and more elongate; interorbital portion more elongate, postorbital processes of frontals rather weakly developed or obsolescent, frontal area relatively narrow (Pl. II), flatter, markedly more sloped or depressed, and somewhat concave; palatal shelf decidedly narrower; posterior part of zygomata less arched dorsally.

TABLE 1.—*Measurements and weights, in flesh, of P. l. maritimus, Blackwater National Wildlife Refuge, Maryland*

USNM NUMBER	SEX	DATE	WEIGHT POUNDS	EXTERNAL MEASUREMENTS MM			SKULL MEASUREMENTS MM					
				Total Length	Tail Vertebrae	Hind Foot	Greatest Length	Condylobasal Length	Zygomatic Breadth	Interorbital Width	Least Width Palatal Shelf	Upper Tooth Row $C-M^2$
265611	♀	6–8–39	8.5	762	254	102	108.9	104.8	63.1	21.4	14.6	41.6
275286	♀	5–31–40	7.0	724	241	102	112.6	106.8	69.1	22.2	15.5	42.4
275287	♀	5–31–40	8.5	762	254	102	112.6	106.8	69.1	22.2	15.5	42.4
271845	♀	11–12–41	7.4	711	216	102	110.0	106.3	61.0	20.6	15.2	40.3
275310	♀	11–13–46	12.4	787	241	111	116.2	112.5	70.9	23.8	16.2	41.0
275289	♀	12–3–46	10.5	756	229	105	107.8	104.4	68.6	23.6	15.5	41.4
275290	♀	12–3–46	11.2	718	210	111	112.2	107.9	68.8	23.6	15.1	41.7
275291	♀	1–22–47	10.8	762	254	114	115.7	110.0	69.9	22.9	15.5	44.8
Average of adult females			9.5	748	237	106	112.0	107.4	67.5	22.5	15.4	42.1
265613	♂	5–18–40	8.5	736	229	102	111.3	105.8	64.5	22.1	16.7	42.0
275295	♂	6–3–40	10.8	800	267	102	114.5	109.6	75.5	22.0	16.1	42.7
265610	♂	6–5–40	9.0	762	254	102	118.6	111.9	69.5	23.2	15.6	44.6
275296	♂	6–10–40	8.5	762	254	102	110.0	107.3	68.3	20.4	14.7	42.3
275297	♂	6–11–40	10.0	787	254	102	109.5	106.1	68.7	22.0	16.0	41.2
266111	♂	11–26–40	10.3	736	229	102	115.4	110.6	69.3	21.9	17.8	43.8
271884	♂	11–24–41	—	—	—	—	108.8	104.7	61.6	20.9	14.9	40.7
271883	♂	12–9–41	—	—	—	—	115.8	110.5	65.7	23.2	16.3	44.6
275311	♂	3–11–47	9.5	749	229	114	115.4	110.6	69.3	21.9	17.8	43.8
Average of adult males			9.5	762	245	104	113.3	108.6	68.0	22.0	16.2	42.9

Weights.—Data given in Table 1 show that the weights of seventeen adult *maritimus* range from 7 to 12.4 pounds and average 9.5 pounds. In contrast, weights of eight adult *lotor* from nearby localities range from 8.5 to 17.4 pounds and average 12.6 pounds.

Baculum.—A rather small series of bacula or penis bones of both *maritimus* and *lotor* have been accumulated for study. Some of these are associated with their respective skins, skulls, and known weights and measurements of the animals in flesh. Consistent differences occur in the relative size and shape of the bacula of the two races; that of *maritimus* is smaller and more distinctly curved or bent as shown in Plate I.

Remarks.—This form appears well adapted for survival under the rather exacting requirements of our eastern tidewater, coastal-marsh conditions. The medium size and slender build fit it for fast traveling in the marsh; the pale coloration blends well with the vegetation of its habitat during most of the season; and the long, coarse-haired pelage can withstand a lot of abrasive action from sharp-edged sedges and coarse grasses. In *Procyon l.*

maritimus the length of the pale subapical band is the greatest yet recorded, nearest that in some western races of *Procyon lotor*, namely, *excelsus*, *pacificus*, *psora*, and *mexicanus*. The

PLATE I

UPPER: Bacula from two of the largest raccoons ever taken on the Delmarva Peninsula: below, Coastal Marsh raccoon, *Procyon l. maritimus*, Shorters Wharf, Maryland, killed in 1895 by Geo. W. James, Emory Clash, and Daniel Young; above, Eastern raccoon, *Procyonl. lotor*, from Kentuck Swamp, Dorchester County, Maryland, by the same party in same year. Actual size.

LOWER: Fresh skins of typical adult males of the common eastern raccoon, *Procyon l. lotor* (below), 14 lbs., and the coastal marsh raccoon, *Procyon l. maritimus* (above), 8 lbs., showing comparative differences in size, coloration, and tails; Golden Hill, Maryland, January 24, 1941.

guard hairs are the longest of any known race except *hirtus* of the Upper Mississippi Valley, in which the hairs average slightly longer.

Specimens examined.—Seventeen adult and six juven le skins and skulls, from the Blackwater National Wildlife Refuge, Dorchester County, Maryland; one from Rehobeth Bay,

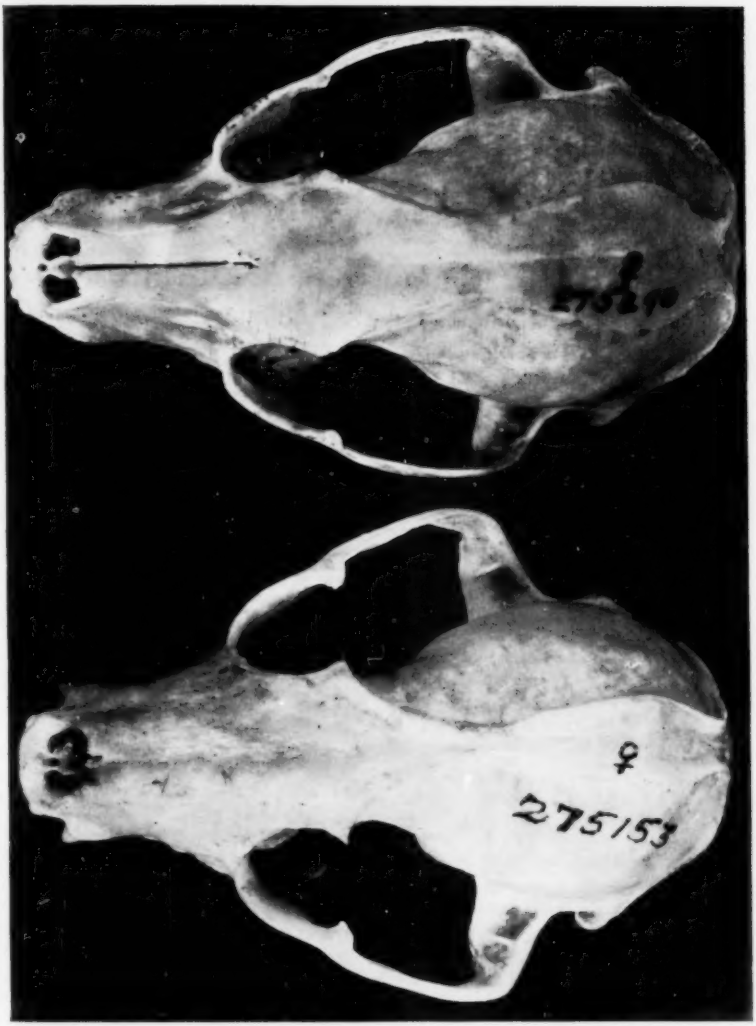

PLATE II

Dorsal view of adult skulls of *Procyon l. lotor* (below, Long Woods, Talbot County, Maryland, U.S.N.M., 275153) and *P. l. maritimus* (above, type, Blackwater Refuge, Maryland, U.S.N.M., 275290). Actual size

Delaware. *Pelts only:* Vienna, Maryland, one; Crocheron, Maryland, one; Blackwater Refuge, Maryland, six; and Saxis Island, Virginia, two. These have been deposited in the Biological Surveys collection, U. S. National Museum, together with a rather extensive

series of representative skins and skulls of typical *Procyon l. lotor* from the same general localities for comparison.

A few examples of what appear to be intergrades have been examined in the series of *lotor* and *maritimus* studied, but it is believed that interbreeding in these two races is relatively rare. The sum of characters presented for *maritimus* throughout its known range shows it to be quite distinct from *lotor*.

U. S. Fur Animal Field Station, Blackwater National Wildlife Refuge, Cambridge, Maryland. Received February 24, 1948.

GENERAL NOTES

THE RACCOON IN THE SALT MARSHES OF NORTHEASTERN FLORIDA

While conducting a habitat distribution survey of mammals on the northeastern coast of Florida, I recently was able to obtain data concerning the natural history of the Florida raccoon, *Procyon lotor elucus* Bangs, in that region. The study was conducted in an area between St. Augustine and Ponte Vendra Beach, from September, 1946, to April, 1947. The field work was made possible by a grant from the Graduate School and by facilities loaned by the Department of Biology, University of Florida.

TABLE 1.—*Activity of raccoons in relation to time and habitat conditions*

DATE	HABITAT	TIME	TIDE	NUMBER	ACTIVITY
		Tidal Areas			
12/30/46	Marsh	3 P.M.	High	1	Inactive
12/31/46	"	10 A.M.	Low	1	Active
2/6/47	"	3 P.M.	Low	1	Active
3/8/47	"	4 P.M.	Low	1	Active
3/8/47	"	9 P.M.	Low	4	Active
3/8/47	Swamp	8 P.M.	Low	9	Active
4/17/47	"	8 P.M.	High	2	Active
		Non-tidal Areas			
3/-/41	Swamp	11 A.M.		1	Inactive
11/29/45	Hammock	2 P.M.		1	Inactive
12/31/46	"	4 P.M.		1	Inactive
1/1/47	Marsh	10 A.M.		1	Active

The area investigated exhibits typical ecological conditions as found on this part of the Florida east coast. A barrier island, consisting of beach, dunes, scrub, hammock, cypress swamp, hardwood swamp, fresh water marsh, pine flatwoods, and hammock, is more or less separated from the mainland by brackish or salty tidal marshes. Most of these habitats, except the salt marshes, are comparatively narrow, lying parallel to one another and to the coast.

The raccoon was found in a number of the habitats studied. Data obtained from twenty-three sight records, a number of trapping records, and from local residents indicate that in hammocks and swamps the raccoons exhibit their usual nocturnal habits, while in the salt marshes a somewhat different pattern of activity is followed. Salt marsh raccoons take advantage of the abundant food supply exposed on mud banks, beaches, and stream bottoms at low tide. This food is composed primarily of crustaceans and molluscs. With food so readily available, raccoons apparently become adapted to a specialized schedule which consists of activity at low tide and inactivity at high tide, almost without regard for day or night (Table 1).

It was found that raccoons do not necessarily retire from the salt marsh at high tide,

although at such times most of the marsh is flooded to a depth of several inches. During high tide, the animals were discovered using special beds located as far as a mile from the nearest dry land. These were low, flat platforms of *Spartina alterniflora* and *Juncus roemerianus*, the two most common plants of the salt marshes. The beds were generally placed about five feet from small, tidal streamlets, some distance from the main channels, and were connected to these streamlets by well-worn, muddy paths.

More typical bedding and nesting places of raccoons were also found in this area. Favorite locations in the salt marsh were hollow cypress stumps and hollow cabbage palm trunks, which occur about the marsh edges. My only breeding record for this subspecies was a litter of five young with unopened eyes, discovered in a cypress stump on March 10, 1939, about twelve miles northeast of the area under consideration. Mr. S. A. Grimes reported finding young raccoons in standing palm trunks in the salt marshes. In the hammocks, one raccoon was found sleeping on a live oak limb, and another in the top of a live cabbage palm. In a nearby swamp a raccoon was discovered occupying a den inside a large clump of Spanish moss, high in a black gum tree.

Tracks of raccoons were seen on almost every part of the marsh, although they were concentrated particularly on banks and beaches, and along tidal streamlets. Regular raccoon trails were found radiating from most of the marsh islands and penetrating the thicker growths of marsh grass. Only the softest mud flats were free of raccoon tracks, while occasionally an adventurous individual had even tried to wallow across one of these. That the mud flats probably act as a barrier to predators is indicated by the fact that shore birds commonly roost in such places.

Like most Florida mammals, raccoons possess an unusually dark fur. Fur of this type, however, when exposed to the strong sunlight and atmosphere of the marshes for one or two days is comparatively lighter and more reddish. This condition was observed repeatedly in specimens found dead on nearby roads and in those which had been trapped and kept in the open. Similarly, the fur of salt marsh raccoons, which are frequently abroad or asleep on the open marsh during daylight hours, is lighter and more reddish than that of raccoons from nearby hammocks and swamps. Of economic significance is the fact that local trappers recognize this difference and do not trap the salt marsh raccoons.—R. DeWitt Ivey, *Department of Biology, University of New Mexico.* *Received February 21, 1948.*

MAMMALS OF NORTHWESTERN TEXAS FOUND IN BARN OWL PELLETS

Mammal remains found in owl pellets are frequently of value as indicators of the kinds of small mammals present in an area and, in a rough way, their relative abundance. Study of a series of pellets may provide more information about certain mammals than weeks of trapping. Subterranean and diurnal forms are likely to be poorly represented in owl pellets, but the presence of rare species is occasionally discovered in this way. The barn owl (*Tyto alba*) is especially famous as a collector of small mammals that are seldom trapped.

The pellets discussed below were collected by the authors on September 1, 1947, in Wheeler County, Texas, at the center of the eastern edge of the northern panhandle. The locality is two and one-half miles west and five or six miles south of Old Mobeetie, and three or four miles north of the North Fork of the Red River. A family of two adult and five nearly grown barn owls lived in the attic of an abandoned, one story ranch house. The heat under the roof of the house was so intense that it is difficult to understand how the owls endured it. Pellets were taken from all parts of the house and no doubt include those of both young and adult owls.

The region around the ranch house is rolling cattle range. It is covered chiefly with shin oak, sagebrush, and grass. The soils near the collection site are very sandy, although in the adjacent parts of the county, red clays, sandy clays, sandy loams, various sands, and caliche occur in a closely varying patchwork. The natural vegetation appears to vary much less. Soils, climate, agriculture, and vegetation of Wheeler County are treated by Bean, Reitch, and Foster (U. S. Dept. Agric., Ser. 1932, 10: 1–34, 1936).

The material consisted of 118 pellets and a mass of debris from pellets that disintegrated in transit. The total content of each pellet was analyzed to determine the number of individuals of each kind represented. Each individual appearing in a pellet was tabulated as one occurrence of its species. Thus, if different parts of an individual were present in two pellets they would constitute two occurrences. This source of error increases the apparent representation of larger forms such as rabbits by an unknown amount. The pellet debris was treated differently. Here the count of occurrences was based upon mandibles, because a larger number of individuals was represented by these bones than by any others. The counts were made from either the right or left mandibles, depending on which was commoner

TABLE 1.—*Vertebrates occurring in barn owl pellets, Wheeler County, Texas*

SPECIES	NUMBER OF OCCURRENCES IN PELLETS	NUMBER OF OCCURRENCES IN DEBRIS	PER CENT OF OCCURRENCES
Cryptotis p. parva	3	0	1
Scalopus aquaticus intermedius	3	0	1
Perognathus hispidus paradoxus	77	23	35
Perognathus flavescens copei (?)[1]	1	1	1
Perognathus m. merriami (?)[1]	5	0	2
Perognathus f. copei or *P. m. merriami*[1]	1	1	1
Dipodomys ordii richardsoni	27	3	11
Geomys lutescens major	3	1	1
Peromyscus sp.[1]	10	0	4
Onychomys leucogaster ssp.[1]	27	3	11
Reithrodontomys, prob. *m. griseus*	11	1	4
Sigmodon hispidus berlandieri	48	2	18
Neotoma micropus ssp.[1]	11	1	4
Mus musculus	1	0	trace
Sylvilagus sp. (juveniles)[1]	14	1	5
Undetermined mammal bones	2	1	1
Bird, very small species	1	0	trace
Totals	283		100

[1] Binomials or trinomials are used in Table 1 where the identifications are satisfactory on morphological or geographic grounds. The determinations of *P. merriami* and *P. flavescens* are queried because these species cannot always be separated by use of the mandibles, the only diagnostic parts remaining. The *Peromyscus* fragments appear to represent more than one species. Subspecies are not given for *Onychomys* and *Neotoma* because the area is one of intergradation. The *Sylvilagus* material may include both *floridanus* and *audubonii*.

in the sample of a given species. Inspection of other bones from the debris did not reveal species unrepresented by mandibles.

It would be preferable in such work to sort all major bones from both pellets and debris into species groups as the material is examined. The number of individuals then may be determined from the commonest bone in the total sample of each species. The contents of the separate pellets can be recorded as each is examined, if this information is desired.

The vertebrates eaten by the owls are listed in Table 1. The only other animals in the pellets were long-horned grasshoppers,Tettigoniidae. Tettigoniids formed an important portion of two pellets and appeared as traces in a few others.

The groups represented are, in order of frequency: Heteromyidae, 139 (50 per cent); Cricetidae, 114 (41 per cent); Leporidae, 15 (5 per cent); Geomyidae, 4 (1 per cent); Sorici-

dae, 3 (1 per cent); Talpidae, 3 (1 per cent); unidentified mammals 3 (1 per cent); Muridae, 1 (trace); Aves, 1 (trace).

Five important prey species make up 80 per cent of the occurrences. On the basis of weight these five species would appear even more important, for none of the really small forms is included. These five are: *Perognathus hispidus*, 35 per cent of the total number of occurrences; *Sigmodon hispidus*, 18 per cent; *Dipodomys ordii*, 11 per cent; *Onychomys leucogaster*, 11 per cent; *Sylvilagus* sp., 5 per cent.

The nine remaining species, each constituting less than five per cent of the occurrences, presumably are actually rare (*Cryptotis*, *Mus*, *Perognathus merriami*, and *P. flavescens*) or of low availability because of protective habits (*Scalopus*, *Geomys*). *Scalopus* may also be rare, for Mobeetie is near the western limit of its known range in Texas.

The conspicuous absence of the two species of ground squirrels known to occur at Mobeetie (*Citellus spilosoma* and *C. tridecemlineatus*) probably reflects the high degree to which their activity is diurnal.

Perognathus merriami is not known to range farther north than Mobeetie in Texas. In the present series it appears to outnumber *P. flavescens*, which is well within its range at this point. The reason for the scarcity of *flavescens* is difficult to perceive, for the area has large amounts of the preferred loose sand habitat.

Mobeetie is the type locality of *P. flavescens copei*, but no collector has succeeded in obtaining topotypes. Gaut obtained three specimens that Bailey (N. Amer. Fauna, 25: 143, 1905) referred to as *copei* topotypes, but on study these prove to be *P. merriami*. We too failed to capture specimens of *copei* and took but one specimen of *merriami*. The suspicion naturally arises that *copei* and *merriami* are the same. Mr. Frederick Ulmer has compared the skull (all that remains) of the type of *copei* with series of skulls of *merriami*, *m. gilvus*, and *flavescens*. He states that the type is definitely of the species *flavescens*. The *copei* remains in the present series of pellets were in too poor condition for positive identification.

The *Cryptotis* specimens constitute the first record of this species in the northern panhandle. The nearest previously known Texas locality apparently is Gainesville, Cooke County, in the north central part of the state (Davis, Jour. Mamm., 22: 413, 1941). Gainesville is about 220 miles from Mobeetie. These specimens also extend the range of *Cryptotis* in Oklahoma westward from Comanche County across the western quarter of the state.

The skull remains of *Cryptotis*, *Perognathus merriami*, *P. flavescens*, and eight good skulls of *Sigmodon* from pellets, have been deposited in the Fish and Wildlife Service collection.—William H. Stickel and Lucille F. Stickel, *U. S. Fish and Wildlife Service.* *Received January 16, 1948.*

SOME MAMMAL NOTES FROM SOUTH CAROLINA

During the war years and the year or two immediately preceding, a few records and observations of South Carolina mammals were made or noted which may be of interest to mammalogists generally.

Sorex fumeus fumeus Miller. Many of the older lists of South Carolina mammals included this species. Neither the writer nor the Charleston Museum has been able to ascertain whether these listings were based on actual specimens in hand, but now no longer in existence, or merely on presumption. At all events, two of the little animals were taken by the writer on November 22 and 23, 1941, in Jones' Gap at an elevation of approximately 3000 feet near Caesar's Head, Greenville County, South Carolina. Both were females and were collected beside the same log on successive nights in traps baited with the usual peanut butter-raisin-bacon-oatmeal mixture.

Dasypterus floridanus Miller. The first record of this bat for South Carolina was published by me in this Journal (vol. 21: 90) in February, 1940. On 25 January, 1943, it was my good fortune to collect a second specimen within one-fourth mile of the spot where the first was taken. The first specimen was an adult female, the second an adult male. These two records, one in July and the other in January, incline the writer to believe that the species occurs regularly near Charleston, S. C., in small numbers.

Peromyscus polionotus polionotus (Wagner). The first record of the old field mouse for South Carolina was published by the writer in this Journal in November, 1939, (vol. 20: 505). At that time I reported that the mouse had been taken in Abbeville, Greenville, and Calhoun counties, and pointed out that these records extended the known range of the animal very considerably to the eastward. On 21 December, 1941, a male was taken in Allendale County, four and one-half miles east of the Savannah River and about twelve miles west of the town of Allendale. This extends the range of the mouse in South Carolina about fifty miles to the southward. It is apparently rare throughout South Carolina. In Georgia, on the west bank of the Savannah, opposite Allendale County, it occurs quite abundantly in all suitable localities.

Oryzomys palustris palustris (Harlan). The writer was definitely surprised to take a young female of this southern species on 22 November, 1941, in Jones' Gap, near Caesar's Head, Greenville County, South Carolina, at an altitude of about 3000 feet. It was taken in a moderately wooded area among thick rhododendrons and laurels along the damp bank of a cold, swift-flowing mountain stream. This was no accidental occurrence since a second individual (a young male) was taken in very nearly the same spot five years later on 29 November, 1946. Within a few hundred yards of the place where both animals were taken, the writer has also taken *Sorex fumeus fumeus* Miller, *Napaeozapus insignis roanensis* (Preble), and *Peromyscus maniculatus nubiterrae* (Rhoads). From this, it would appear that *Oryzomys* has established itself in this locality well beyond its normal range. It would also appear that a tongue of the Canadian Zone extends into South Carolina near Caesar's Head for a short distance.

Zapus hudsonius americanus (Barton). This species has been twice recorded, of recent years, from South Carolina: from Anderson County by Sherman (Jour. Mamm., 18: 513), and from Greenville County by the writer (*Ibid.*, 22: 91). On 8 June, 1947, the writer collected an adult female of this species at Table Rock State Park, Pickens County. Pickens County lies between Greenville and Anderson counties, and it was to be supposed that *Zapus* would occur there.—ROBERT H. COLEMAN, *Route 5, Box 615, Charleston, S.C.* *Received Oct. 3, 1947.*

A RECORD OF THE SHREW *SOREX NANUS* FOR WYOMING

On August 26, 1947, a dwarf shrew, *Sorex nanus* Merriam, was trapped at the base of the talus on the west slope of Corner Mountain (Section 28, Township 16 N, Range 78 W), the Medicine Bow National Forest, Albany County, Wyoming, at an altitude of 8500 feet. The point of capture of this specimen is only about seventy miles northwest of the type locality, Estes Park, Colorado. Nevertheless, I find no previous reports in the literature for this species from Wyoming. In addition, the record is of interest because of the rarity of the dwarf shrew. After checking reports, I have concluded that possibly only three other specimens are at present extant.

This shrew was caught sometime between 8:00 A.M. and 11:00 A.M. on a clear day. It was a female without embryos. It bears my field number 184. The external measurements in millimeters were: 91–39–10.5–7. The weight was 2.5 grams. Measurements of the skull, also in millimeters, were: condylobasal length, 14.1; palatal length, 5.3; cranial breadth, 7.1; least interorbital breadth, 3.0; maxillary breadth, 4.0; maxillary tooth row, 5.1. Identification of the specimen has been confirmed by E. Raymond Hall, Museum of Natural History, University of Kansas, Lawrence, Kansas.

On Forest Service maps of the Medicine Bow National Forest, printed in 1940 and 1941, the mountain, at the base of which this shrew was trapped, is named Corner Mountain. On the same maps, Bald Mountain is located approximately two and one-half miles east and three-fourths mile north of the peak of Corner Mountain. On the peak of Bald Mountain there is a bench mark at 9582 feet. Residents of the area tell me that names of the two mountains, as given on the Forest Service maps, conform to local usage. These names seem to be appropriate. I have, therefore, followed the usage on the Forest Service maps. However, the U. S. Geological Survey topographic map of the Medicine Bow Quadrangle (edition

of Dec., 1908) has the name "Corner Mtn" printed at the location of the peak labeled "Bald Mtn." on the Forest Service map. It is thought that this discrepancy between the maps should be called to the attention of mammalogists who might wish to check the locality.—Arthur B. Mickey, *University of Wyoming, Laramie, Wyoming. Received January 26, 1948.*

A RECORD OF THE SHREW *SOREX NANUS* FOR ARIZONA

On September 17, 1937, a dwarf shrew, *Sorex nanus* Merriam was captured by Lloyd Davis, fence foreman of the National Park Service, on the North Rim of Grand Canyon, Arizona. The location was nine miles east of Swamp Point within Grand Canyon National Park, close to the boundary of the Kaibab National Forest. The elevation was approximately 8000 feet. The specimen was a male; length, 83 mm.; tail, 27 mm. It was captured while running along a fallen tree trunk. The study skin and skull bear catalog number M-372 in the Grand Canyon National Park study collection.

The specimen was sent to the Biological Survey, Washington, D. C., February 19, 1940, for determination. They submitted it to Dr. Jackson, authority on the genus *Sorex*, who identified it as the very rare species *Sorex nanus*, which was originally described from Estes Park, Colorado, but of which only two specimens have previously been known.—Louis Schellbach, III, *Grand Canyon National Park, Grand Canyon, Arizona. Received January 19, 1948.*

FURTHER RECORDS OF THE WOLVERINE FOR WISCONSIN AND MICHIGAN

At the meeting of the Wisconsin Academy of Sciences, Arts, and Letters, July 19, 1870, the following donation to the Museum was acknowledged: "A wolverine (*Gulo luscus*, Sabine) killed in Juneau County, and presented by Hon. J. T. Kingston, of Necedah." (Trans. Wis. Acad. Sci., 1: 186, 1872). The collections of the Academy were destroyed in the burning of the State Capitol, February 27, 1904. This record, combined with the previous note (Jour. Mamm., 27: 90, 1946), shows clearly that the wolverine ranged into the southern half of the state. The Medford (Wis.) *News*, June 8, 1876, mentions that among the animals presented for bounty in Taylor County, since January 1, was one wolverine.

E. N. Woodcock (Fifty Years a Hunter and Trapper, A. R. Harding, Columbus, [c1913] 130-31), trapped in Schoolcraft County, Michigan, in the 1880's. He stated: "We were bothered some by having a wolverine follow a line of deadfalls, tear down the bait pen and take the bait, but we would not allow him to do his cussedness long before we would put a trap in the way."—A. W. Schorger, *168 N. Prospect Avenue, Madison, Wis. Received March 10, 1948.*

A COYOTE, *CANIS LATRANS*, FROM PREBLE COUNTY, OHIO

On January 8,1947, there was a report of a coyote killed by a farmer near Fairhaven, Preble County, Ohio. Mr. C. F. Nelson of the Zoology Department, Miami University, and myself proceeded to the farm to examine the specimen. It proved to be a male *Canis latrans* weighing approximately thirty-five pounds. The approximate total length of the skin was 1187 mm. From the appearance of the skull and teeth it did not appear to be a particularly old individual. The farmer who shot it reported that a good many of his shoats had been disappearing prior to the time the animal was killed, and he attributed their loss to the coyote. The skin and skull now reside in the Mammal collection of Miami University, Oxford, Ohio.—N. C. Negus, *2181 Briarwood Rd., Cleveland Heights, Ohio. Received January 27, 1948.*

PREDATION ON THE DOMESTIC PIG BY THE LONG-TAILED WEASEL

On April 20, 1943, a large male weasel (*Mustela frenata primulina*) was brought to the writer for identification by Albert Etzel of Marion, Iowa. The specimen was in brown

pelage and weighed slightly over seven ounces. Mr. Etzel killed the weasel with a shotgun after he found it attacking a three-day-old baby pig in his hog lot. A subsequent visit to this hog lot by the writer resulted in the finding of another young pig of the same litter in a cache under a pile of posts. This latter pig had part of the flesh eaten away from the base of the skull just back of the left ear. The weasel's nest was found in this same post pile; it consisted of a litter of grass, cottontail fur, pigeon feathers, and the remains of house mice.

It appeared that this dead pig was killed and cached by the weasel. The attack upon the other young pig, which was observed by Mr. Etzel, tends to confirm the fact that this is an outright case of weasel predation. The young pig taken from the cache weighed slightly over two pounds; the one attacked weighed two pounds and seven ounces. Chickens and rabbits weighing much heavier than this and better able to resist the attacks have often been known to fall prey to weasels, but this is the only instance where the writer has learned of the domestic pig being attacked.—EMMETT B. POLDERBOER, *Loras College, Dubuque, Iowa. Received February 20, 1948.*

LATE FALL SEXUAL ACTIVITY IN AN IOWA LEAST WEASEL

Least weasels are supposed to range over the entire state of Iowa, but definite subspecific classification and life history studies have not been completed in this region because of lack of a good series of specimens and data. The writer has taken six specimens from northeastern Iowa counties during the months of January and December—all males in winter pelage. None of these males showed signs of sexual activity; in all, the testes were retracted and diminutive in size. Three of these specimens were from Butler County and were given to Dr. Thomas Scott at Iowa State College, Ames, Iowa. One Dubuque County specimen is mounted and kept in the writer's private collection. Each of these specimens has a few black hairs in the tail tip; a characteristic assigned to *Mustela rixosa allegheniensis*.

A male least weasel in brown pelage was taken November 17, 1945, at Marion, Iowa. This specimen had large testes that had descended into the scrotum. The testes, when removed, were about the size of medium-sized garden peas. Microscopic examination of the testes and the vasa deferentia showed mature sperms to be present. Dr. William J. Hamilton, Jr., in his book on mammals of the eastern United States, mentions that the young of these weasels have been found in Pennsylvania during the months of October, January, and February. According to Hamilton's records it would appear that November could be a normal month for breeding. It may be of some significance, in determining gestation periods, that no sexually active males have been taken in late December and January. The sexually mature November specimen is mounted and kept in the writer's private collection. —EMMETT B. POLDERBOER, *Loras College, Dubuque, Iowa. Received February 20, 1948.*

THE LEAST WEASEL (*MUSTELA RIXOSA*) IN WASHINGTON

While trapping for mink five miles southwest of Battle Ground, Clark County, Washington, during December, 1935, I caught a male least weasel (*Mustela rixosa* Bangs). It was taken in a small marsh which headed an intermittent stream. Parts of the marsh were wet enough to hold muskrats throughout the year, but most of it was relatively high and held good populations of *Microtus*. This area was hunted regularly by both mink and the larger weasels which are common in this locality.

This least weasel was a male in brown pelage (none of the weasels turn white in the winter in this locality). The upper parts and sides were brown, the underparts were white, and there was a white flecking on one cheek. The tail was about one and one-half inches long and was all brown. The overall length was between seven and eight inches.

The skull was crushed by the steel trap and was not saved. The skin was saved, but a short time later it was accidentally destroyed. I have handled many specimens of North American weasels and am sure that there can be no doubt as to its identity. Even without the specimen, I feel that this observation should be recorded since I know of but one possible and one positive record of the species in Washington. The first specimen was recorded by Baird (1857 Rept. Explor. and Surv., 8: 159–61.) and had been collected by Dr. George

Suckley from Fort Steilacoom. This specimen was later considered by Bangs (Proc. Biol. Soc. Washington, 10: 1–24, 1896) to be an immature specimen of the *cicognanii* group. Swenk (Jour. Mamm., 7: 313–30, 1926) followed this opinion in his review of the least weasels and further speculated that it was probably *Mustela streatori* Merriam. The second specimen was an adult female which was taken on July 1, 1931, at Port Angeles (Svihla and Svihla, Murrelet, 13: 24, 1932).

The least weasel is undoubtedly a rare animal in this area as it is in much of its range. It is to be expected that a northern animal such as the least weasel would follow the Cascade Mountains south at least as far as the barrier of the Columbia River.—James R. Beer, *University of Wisconsin, Madison, Wisconsin.* *Received March 4, 1948.*

RED SQUIRRELS AND GRAY

The Frith or Laboratory Grounds near Butler, Pennsylvania, comprise some ninety acres enclosed in a high fence. Perhaps half the area may be considered as woodland. During the last eight years, red squirrels (*Tamiasciurus*) and grays (*Sciurus carolinensis*) in some numbers have been present every year, and presumably at all times during each year. There are also many flying squirrels (*Glaucomys*) and chipmunks (*Tamias*), but no fox squirrels, though these occur on the neighboring countryside. The grays confine themselves, most of the time, to the larger timber in the valley below the laboratory buildings; so do the flying squirrels. The reds seem more plentiful in the broken coppices near the hilltop, but are found in the other timber, too. Chipmunks are everywhere. For the whole area, it seems likely that the grays are several times as numerous as the reds. Within the Frith, neither species is subjected to hunting pressure.

Seeing that there is a common belief that reds drive out grays, and pursue and mutilate them,the fact that there seems to have been no change in their relative abundance for eight years may be significant. We happened to catch a number of squirrels of both species uninjured in box traps set for rabbits, and placed three grays and a red in a large cage, some five feet square and eight feet high, provided with several den boxes. The grays seemed somewhat afraid of the red, but all lived together for some weeks. Finally the red escaped and the grays died; but the latter showed no signs of injury. This experiment was therefore inconclusive.

One Sunday noon late in August or early in September 1945, at 12:30 P. M., E.D.S.T., I was walking alone quietly in the grounds, near what might be considered the boundary between typical gray and red territories. The red squirrels in fact occupied a den box within a dozen yards earlier in the year, while a family of grays was raised a few score yards away.

There was a sudden scurry in the leaves on the ground to the south of me, and, as I stopped perfectly still, a gray squirrel burst through a wire fence closely pursued and occasionally thrown half-sidewise by a red. Both animals ran over my feet, apparently unaware of my existence. Some ten yards beyond me, they turned left, and went up towards the pheasant pens. I noted the time and, as I could still hear them rustling the leaves, waited. In fifteen or twenty seconds, they came back, the pursuit as hot as ever, and the red never more than a couple of feet behind the gray. They passed close in front of me and ran down the hill towards the taller timber. The rustling died out in the distance. Then two and a half minutes after I first met them, the red, or at any rate a red, reappeared alone from the direction in which they had disappeared, hopped through the fence a few yards east of where he originally crossed it, ran three or four feet up a tree, and looked around. He then descended to the ground and ran about the same height up another tree, again looking around. Apparently he wanted to see over the weeds and grasses. After repeating this inspection from two or three trees near each other, he finally ran up out of sight towards the top of a sizeable white oak.

I followed as nearly as I could the trail of the two animals, but saw neither blood, corpses, nor live animals.

The chase, whatever its nature, was entirely on the ground, though entirely in woodland.

The pace was hot, the chase lasted at least a minute and a half, and covered some hundreds of yards. It had every appearance of being serious, and the red a couple of times, at least, caught the gray by the rear and threw it partly on its side, though it never seemed to get a firm hold. I have no idea of the sex of either animal. The breeding season was long since past, but the red may have been chasing the gray, as an intruder, off his property. So far as the evidence goes, it looks as though the red gave up the pursuit without inflicting injury, when the gray reached gray territory.

The fact that the animals ran over my shoes, whereas normally they will not come within many yards, indicates how intent they were on pursuit and escape; and the fact that the gray did not take to the trees, which were plentiful enough, and its normal refuge, seems to indicate that it felt safer on the ground with this pursuer. The fact that it did not keep to the cleared forest paths, which were available to it, but seemed deliberately to leave them for the weeds, briars, and fallen leaves, may have some significance; and the fact that it first turned left towards the pheasant pens, which are not in gray territory, and then reversed its direction, is a little puzzling, though it may have arisen from the pursuit being momentarily too hot, the gray being thrown, and any port looking good in a storm.—F. W. PRESTON, *Butler, Penna. Received January 22, 1947.*

HABITAT OF THE GOLDEN MOUSE IN VIRGINIA

To the meager literature on *Peromyscus nuttalli* may be added the following notes from Virginia. Apparently this interesting mouse occurs throughout the southern third of the State, from near sea level in the Dismal Swamp in the southeast, through the Piedmont, to elevations as great as 2800 feet in the mountains of the southwest. Here at the northern edge of its range it is more restrictive in its choice of habitats than it is farther south and is probably completely absent from wide areas because of lack of suitable habitat.

It is a woodland mouse, but the type of forest seems to be of little concern, for it is found with equal frequency in pine and oak and other associations. In the Dismal Swamp it is most common about the edges of cane breaks and in moist thickets (Fisher, A. K., unpublished field notes, 1895). Farther westward, in the Piedmont upland and in some parts of the mountains, it seems to be confined quite closely to thickets of honeysuckle (*Lonicera japonica*), and is seldom found in other situations. In many instances, it appears to be further restricted to thickets of honeysuckle near water. A high percentage of specimens from the lower Piedmont counties of Amelia and Brunswick (Lewis, J. B., Jour. Mamm., 21: 427, 1940, and unpublished field notes, 1945) have been taken on the banks of streams or ponds, or in moist places not more than thirty yards from water. Honeysuckle is equally abundant both in dry and in moist situations in these areas. In the upper Piedmont and in the mountains, *nuttalli* has been found, sometimes in numbers, far from water, though nearly always in honeysuckle. Incidences of departure from the usual honeysuckle habitat have been observed in certain mountain areas. A nest and a single mouse were found on the crest of Brush Mountain (2800 ft.), Montgomery County, in a thicket of greenbrier (*Smilax*) and blackberry (*Rubus*) in the midst of an extensive dry second-growth oak forest. Two others were trapped on Powell Mountain (2750 ft.), Scott County, in blueberries (*Vaccinium*), St. John's-wort (*Hypericum*), and annuals at the edge of a marshy clearing in dry second-growth oak forest.

In the Piedmont and Coastal Plain, *nuttalli* is relatively abundant, but that it is scarce in the mountains is attested by the fact that only four specimens have been taken despite considerable trapping. For instance, a single individual was caught by accident in a bird-banding trap at Blacksburg in 1935, but intensive trapping in the same and in nearby areas in twelve subsequent years failed to produce a second specimen.

The species is distinctly arboreal, and all of the nests that have been found in Virginia have been in bushes or have been suspended in trailing vines of honeysuckle or greenbrier. The nests are globular, generally six to eight inches in diameter, and are composed of leaves and sometimes shredded bark. They are located from five to ten feet above the ground and are often conspicuous, especially in winter. When the nests are disturbed, the mice fre-

quently try to escape by climbing upward in the vines and tree branches; some have been observed to ascend to the very tops of trees, as much as twenty feet above the gound. The mice may leap without apparent objective from nests which are too roughly disturbed, and those which fall to the ground usually attempt to escape into ground cover. It is evident that their normal movements too must take them often to the ground, for they are readily caught in traps placed there.—CHARLES O. HANDLEY, JR., *Museum of Zoology, University of Michigan, Ann Arbor, Michigan. Received January 30, 1948.*

AQUATIC HABITS OF THE NORWAY RAT

Perhaps a major reason why the Norway rat (*Rattus norvegicus*) is America's—and probably the world's—most destructive mammalian pest is because of its great adaptability, both to its habitat requirements and food preferences. This extreme versatility in environmental and food requirements, along with its amazing degree of fecundity, almost insures wide dispersal, so that where conditions are at all favorable and no control practiced, a surprisingly high population rapidly develops. We normally think of the rat as being dependent upon buildings or human habitation; yet many colonies of dense population are known to live entirely in the wild. These numerous pockets of infection insure reinfestation of areas where the pests have been removed unless rat proofing and good sanitation methods are continuously practiced. Consequently, the rat control problem seems to be ever with us.

An example of its adaptability was recently brought to my attention at the U. S. Fish Hatchery station at Leetown, West Virginia. Despite the fact that several buildings and food storage bins are kept reasonably free of rats from 50 to 200 yards distant, a surprisingly large colony was found living in earthen banks adjacent to the fish ponds and stream courses where concentrations of fish are kept. The spawn, fingerlings, and adult fish—primarily of species or varieties of trout and bass—are fed horse meat daily as well as other prepared foods that are equally acceptable to the rat colony. Undoubtedly bits of food accidentally dropped on the bank in feeding operations accustom the rats to that type of diet. It is obvious that an inadequate food supply occurs on the land, and the rats have learned to obtain it from the water. In their competition for food, the young and small fish at all hatcheries concentrate in enormous numbers when food is thrown into the water. Consequently, food is available for a very short period only. The rats as well as the fish have learned this. Therefore, at this hatchery these normally nocturnal rats have synchronized their feeding time to correspond with the feeding of the fish. When food is thrown into the water, the rats have no hesitancy in competing for it. They swim well and rapidly. After the food in the water is consumed, they then seek tidbits inadvertently dropped on the bank.

Apparently low temperature is no serious deterrent to the rats' aquatic activity. On the day of my visit, December 10, 1947, the temperature was considerably below freezing, and an unpleasant sleet and snow storm was in progress; even so, a dozen rats were observed in the water, and part of their runway extended through small arms of the stream. While omnivorous rats avidly consume all kinds of fish food, it was a surprise to find that they are not at all averse to preying on young fish. On a number of occasions the rats have been observed catching fingerling fish and taking them into their ditchbank runways or burrows. —CLARENCE COTTAM, *Fish and Wildlife Service, U. S. Department of the Interior, Washington, D. C. Received February 9, 1948.*

HIBERNATION SITE OF THE MEADOW JUMPING MOUSE

On November 14, 1947, two jumping mice, *Zapus h. hudsonius*, were uncovered by my father, Harry A. Dilger, in a garden at Hilton, Monroe County, New York. The animals, a male and a female, were huddled close together, lying on their sides; the tails circled the body forms. The hibernating chamber was constructed of a nest of coarsely shredded dry grass placed above ground in a layer of compacted wood ash which was about seven inches thick. This spot has been used by my father to burn brush and refuse for several years.

The female, injured by a spade, died within a few days after capture. Her weight at

death was 22 grams with the customary layer of fat over the body. The male, kept for eleven weeks, was later killed in an emaciated condition in the building where it was housed and where it had escaped. Presumably these zapids would have frozen in the chamber they had selected for winter quarters. Temperatures of −16° F. were recorded from the area during the month of February.—WILLIAM C. DILGER, *Ithaca, New York. Received March 10, 1948.*

FURTHER NOTE ON THE EUROPEAN WISENT

Richard Glover's article in the November issue on the Wisent or European bison was interesting to me as I have just returned from Poland. While there, I looked up the wisents and discussed their status with Polish foresters in whose care they are entrusted.

Some eighteen years ago I visited Bialowieza (Bialowies according to Glover). This immense old-growth forest was the natural home of the wisent in recent centuries. It ran from the sandy pine lands near Bialystok in the east and north to the Pripet marshes in the east, a vast island virtually trackless and unknown except to the foresters and game keepers. It produced alder, birch, willow, beech, ash, and oak, which furnished ample browse, in addition to a wild oat and other herbs which are the normal food of these bison during the summer period.

Soon after the outbreak of World War II, the Polish Chief Forester, Jan Miklasewski, undertook to preserve the wisent. He sent his Chief Inspector and the Regional Forester at Bialystok to Moscow to consult with the Soviet authorities. After considerable negotiations, the Russians agreed to the proposals and made any killing of the wisent punishable by death. Signs to this effect were posted throughout the Bialowieza Forest and Russian speaking Polish foresters were assigned the task of watching over and caring for the animals. During the Russian occupation of eastern Poland only one wisent was killed, a crime for which three Russian soliders were executed.

The first German attack upon the Russians caught the latter by surprise and they retreated in disorder far to the east of the Bialowieza Forest. The Polish foresters who were protecting the herd were also placed in jeopardy by the advancing Germans. One was sent to a concentration camp before he could get a hearing. Finally, a German officer was found who was personally interested enough to call attention to the authorities on the need for preserving the animals. Again signs were put up, this time in German, forbidding the killing of the wisent. However, this action was not taken until after several of the animals had been killed. This time German game keepers were substituted for the Poles, but one Polish forester, disguised as a peasant, continued to watch as best he could over the herd.

News of the wisents reached the Chancellery in Berlin. Hitler asked that some of the animals be caught and sent to Berlin. Just how many were so shipped no one now appears to know, but at least five and possibly as many as ten were taken at one time. The Poles believe that perhaps twenty-five animals in all were taken to Germany during the occupation.

The Russian return drove out the Germans and again the animals were in danger. However, the Polish forester came out of hiding and took over the job of protecting the animals. This time he was successful in keeping out all intruders for he still had preserved the decree issued by the Russians earlier.

The "Curzon Line" decided upon at Yalta gave to Soviet Russia a considerable part of the territory formerly in pre-war Poland. This line as surveyed passed through the wisent enclosure. Again the same Polish forester, now Regional Forester at Bialystok, engineered a slight jog in the line which kept virtually all the 140-acre paddock inside present-day Poland.

The Bialowieza Forest herd now numbers nineteen animals, eight males and eleven females, including seven calves under two or three years. Whether the Poles can keep this herd intact remains to be seen for Russia is now demanding five calves as its share of reparations. This transfer the Poles are currently vigorously protesting, but the Polish government being what it is, there may be no choice.

Another herd of wisents is in Silesia near Pszczyna. Here are twenty-five animals.

Five of these are calves. None of this herd suffered during the war. One forester jocularly said the reason was that the Germans were too busy exterminating Poles at nearby Oswiecim to bother with a few strange animals. However, the Polish foresters who were in charge of the herd were not so fortunate. Polish foresters assert that the only predatory animals they fear are wolves and bears. Every year wolves are killed about the tight enclosures and occasionally bears are troublesome in the spring.—E. N. MUNNS, *Division of Forest Influences, U. S. Forest Service, Washington 25, D. C. Received January 16, 1948.*

A SUPERNUMERARY INCISOR IN THE WHITE-TAILED DEER

On May 29, 1947, the carcass of an adult male white-tailed deer, *Odocoileus virginianus borealis* (Miller), was found on the Department of Lands and Forests' Wilderness Area in Algonquin Park, Ontario. Examination of the lower jaw revealed the presence of a supernumerary incisor on the left side. As far as could be determined, the extra tooth lay between what would normally be the second and third incisors. It resembled the tooth on its left, but was slightly longer and wider. It appeared to be sound and functional in every respect and its presence had not induced any visible deformity in its neighbours. The left incisiform row had merely been extended by the width of the extra tooth. Cowan (Can. Jour. Res., *24*(D): 71–103, 1946) states (p. 96): "Variations in the numbers of teeth in the genus *Odocoileus* are rare" and cites one case in *O. hemionus* in which nine lower incisors were present.—C. DAVID FOWLE AND R. C. PASSMORE, *Division of Research, Ontario Department of Lands and Forests, Toronto, Ontario. Received March 15, 1948.*

THE MAMMAL COLLECTION OF THE NATURAL HISTORY MUSEUM OF STANFORD UNIVERSITY

When Doutt, Howell, and Davis were preparing their paper on "The Mammal Collections of North America" (Jour. Mamm., 26: 231–72) it was not possible to supply them with the required data regarding the mammal collection at Stanford University. The present note corrects this omission.

At present, the Natural History Museum has 4081 catalogued mammal specimens representing the following thirteen orders: Monotremata, 3; Marsupialia, 17; Edentata, 2; Pholidota, 1; Insectivora, 114; Chiroptera, 581; Primates, 1; Lagomorpha, 150; Rodentia, 3064; Sirenia, 1; Cetacea, 1; Carnivora, 129; Artiodactyla, 17. In this grouping are included thirty specimens of rodents and four of lagomorphs which are designated as holotypes or paratypes. The collection also contains a fossil sirenian and a seal, both of which are holotypes. The collection consists chiefly of study skins and skulls, although alcoholic specimens and skeletons are also represented.

The families best represented are the Sciuridae and the Cricetidae. The genus represented by the greatest number of specimens is *Eutamias*. Although the collection contains specimens from all over the world, the state of California is best represented, with sizeable numbers of specimens from Arizona, Mexico, the Galapagos Islands, and Alaska.

The number of specimens in the mammal collection places it among the twenty-five largest in the United States as listed by Doutt, Howell, and Davis. The writer is, at present, revising the mammal collection and an additional 500 specimens are expected to be added when material now in storage is identified and cataloged. Professor G. S. Myers is in official charge of the collection.—WILLIAM V. MAYER, *Natural History Museum, Stanford, California. Received March 13, 1948.*

A LIST OF THE NAMED FORMS OF THE POCKET GOPHER GENUS *CRATOGEOMYS*

A bare list of the names is a poor offering, ordinarily not worth printing unless it embodies much new information or is set forth to meet an immediate need. It is for the latter reason that the present list is printed. It is a collation of information already published and is intended as an aid to those in the United States National Museum who are now preparing a check list of North American Recent mammals. The present list brings up to date the

information on the status of the named forms that comprise the genus *Cratogeomys*, and may serve as a working basis for future studies of those forms. Most of the published information on the relationships of the species and subspecies of the genus is to be found in the reports mentioned in the following brief historical summary. In 1895 Merriam (N. Amer. Fauna, no. 8) revised the pocket gophers of the family Geomyidae, exclusive of the genus *Thomomys*. Nelson and Goldman, in 1934 (Proc. Biol. Soc.Wash., 47: 135–54), reviewed the genus *Cratogeomys* and recognized twenty-five geographic races, sixteen of which were described as new. Goldman described *Cratogeomys perotensis peraltus* in 1937 (Jour. Wash. Acad. Sci., 27: 402–404). Two years later (Jour. Mamm., 20: 87–93, 1939) the same author reviewed the genus *Platygeomys;* ten species and subspecies were recognized, four of which were new. Davis in 1944 (Jour. Mamm., 25: 386–88), indicated that *oreocetes* and *peregrinus* were not distinct from *Cratogeomys merriami merriami;* he also gave evidence for treating *C. m. irolonis* as a full species. In 1946 (Jour. Mamm., 27: 397–99), Hooper pointed out that the gophers of the genera *Cratogeomys* and *Platygeomys* were not greatly different, and suggested that they be treated as comprising two species groups of one genus, to which the name *Cratogeomys* should apply. The next year (*op. cit.*, 28: 45–46, 1947) he described a form which he considered to be subspecifically related to *Cratogeomys tylorhinus* and *C. planiceps*.

It is not to be inferred from this list that the writer concurs fully as to the taxonomic status of all of the forms. Some are known only from one or two specimens, which is far from a satisfactory sample for appraisal of the characteristics of species and subspecies. Other forms, represented by more complete material, have not been studied in sufficient detail to yield the necessary information as to their status. Future study will undoubtedly lead to many changes in the list. But as of the present date the species and subspecies of the genus *Cratogeomys*, as now understood, are as follows:

GENUS *CRATOGEOMYS* MERRIAM

castanops group

Cratogeomys castanops castanops (Baird)
Cratogeomys castanops perplanus Nelson and Goldman
Cratogeomys castanops lacrimalis Nelson and Goldman
Cratogeomys castanops hirtus Nelson and Goldman
Cratogeomys castanops angusticeps Nelson and Goldman
Cratogeomys castanops clarkii (Baird)
Cratogeomys castanops consitus Nelson and Goldman
Cratogeomys castanops tamaulipensis Nelson and Goldman
Cratogeomys castanops convexus Nelson and Goldman
Cratogeomys castanops excelsus Nelson and Goldman
Cratogeomys castanops subsimus Nelson and Goldman
Cratogeomys castanops goldmani Merriam
Cratogeomys castanops subnubilus Nelson and Goldman
Cratogeomys castanops planifrons Nelson and Goldman
Cratogeomys castanops rubellus Nelson and Goldman
Cratogeomys castanops peridoneus Nelson and Goldman
Cratogeomys merriami merriami (Thomas)
Syn. *Cratogeomys oreocetes* Merriam
Cratogeomys peregrinus Merriam
Cratogeomys merriami saccharalis Nelson and Goldman
Cratogeomys irolonis Nelson and Goldman
Cratogeomys perotensis perotensis Merriam
Cratogeomys perotensis estor Merriam
Cratogeomys perotensis peraltus Goldman
Cratogeomys fulvescens fulvescens Merriam
Cratogeomys fulvescens subluteus Nelson and Goldman

gymnurus group

Cratogeomys gymnurus gymnurus Merriam
Cratogeomys gymnurus inclarus Goldman
Cratogeomys gymnurus imparilis Goldman
Cratogeomys fumosus Merriam

Cratogeomys angustirostris Merriam
Cratogeomys varius Goldman
Cratogeomys tylorhinus tylorhinus Merriam
Cratogeomys tylorhinus arvalis Hooper
Cratogeomys tylorhinus planiceps Merriam
Cratogeomys zinseri Goldman
Cratogeomys neglectus Merriam

EMMET T. HOOPER, *University of Michigan Museum of Zoology, Ann Arbor, Michigan.*
Received April 28, 1948.

REVIEWS

Bobrinskoy, N., B. Kuznetzov, and A. Kuzyakin. Edited by N. Bobrinskoy. Illustrated by C. Flerov, N. Kondakov, and N. Ianshinov. MAMMALS OF USSR. Moscow, USSR Government Publishing Office (Sovietskaya Nauka). 8vo, cloth, pp. 440, plates 32, text figs. 256, maps 62. 1944. In Russian, with a preface translated in English.

Need for a general reference book covering the systematics, geographical distribution, and principal biological features of the mammals of the United Socialistic Soviet Republics, particularly for the use of students in colleges and universities, prompted the issuance of this book. Treatment of the different orders, genera, and species varies somewhat in accordance to the data and information available. On the whole the compilation of such data appears to be well done, and the book should be an important factor in furthering among the Soviet peoples a knowledge of their native mammal fauna. The book is really an assemblage of parts written by the different authors and edited by N. Bobrinskoy, who also prepared the key to mammalian orders, wrote the parts dealing with carnivores, pinnipeds, cetaceans, and ungulates, and the chapter on Chief Principles of Systematics. A. Kuzyakin did the chapter on bats, and both N. Bobrinskoy and A. Kuzyakin the one on insectivores. The chapter on rodents was written by B. Kuznetzov.

Mammals of USSR is well supplied with illustrations made especially for the book. The plates done by C. Flerov, principally from sketches (apparently in heavy crayon or charcoal) made directly from nature during his zoological excursions, are among the best of this type the reviewer has seen. Some of these plates contain on each several sketches of individual mammals. Others such as, for example, those of the Tibet bear with two cubs, the wild boar with six young, the caracal, the saiga antelope, the goral, and the Poli sheep have a single species to a plate, and display animal action in an artistic, yet natural, habitat. Line drawings of skulls and other mammal parts are in some cases not so proficiently done, but are adequate. Some of these figures are slightly out of alignment on the page, which may not deter their identification worth, but is somewhat distracting to a methodically precise eye. The black and white figures of bats, pinnipeds, and cetaceans, were made by N. Kondakov; those of ungulates and rodents, by C. Flerov; and those of carnivores by N. Ianshinov.

Important are the 62 maps that display the known distribution of many of the species. Keys are constituted as far as possible so that one is able to determine the scientific name of the mammal by its skin or by its skull alone. There is a bibliography of more than one hundred titles, all of which, except two German publications, are of Russian literature.

Bobrinskoy closes his preface with the interesting comment "Though our work was chiefly prepared before the beginning of this Great National War, the definite arrangement of it including some new material, and the preparation of illustration and maps went on under the difficult conditions of wartime. In spite of these difficulties we nevertheless hope that we succeeded in bringing our book to a satisfactory end, contributing thereby to the development of cultural work at a time when a great struggle is being led by our people against the cruel and implacable enemy who dared to violate our independence."—HARTLEY H. T. JACKSON.

Ashbrook, Frank G. Fur Farming for Profit. New York: Orange Judd Publishing Company, Inc. 8vo, pp. 429, text figs. 166, mostly halftones. January 30, 1948. Cloth, $4.00.

One might judge by the title page of this book that it is simply a "revised and reset" edition of Fur-farming for Profit, 1928 (review in Jour. Mamm., 9: 157, May, 1928), by the same author. So changed is it from the previous book under this title, however, that it could well have been given a new title, except that the old one so appropriately fits the book. There have been issued in the interim since the first edition other publications of varying completeness on the raising of fur animals, some of them on individual species, yet as in the former review we can repeat that the present volume constitutes the only broad and comprehensive treatment of the field from an unbiased viewpoint. It would be useful on the bookshelves of any fur farmer, and is a "must" in the hands of beginners in fur farming.

Although the new volume has 106 more pages with larger type bed than the old, the actual reading matter has not been correspondingly increased, as there are more illustrations and the type-font is larger and more legible. All in all, the typography, paper, binding, and the workmanship on the book as a whole are an improvement on the first edition, which sold at the same price. In these days of doubled and trebled prices it is hopeful to see an item that has been lowered in price for value received.

The contents of the present work have been well broken down into chapters. We find such topics discussed in sequence as follows: history and development of fur farming; fur farming areas; advice to beginners; selecting a fur farming site; essentials of breeding; essentials of feeding; general management of the fur farm; prevention and treatment of disease; fox farming; mink farming; raising other fur animals; transporting live animals; pelting; marketing furs; associations and co-operatives; fur animal exhibitions; index. Again we find no bibliography or references in the book, which your reviewer feels is unfortunate. It would appear that some publishers of commercial books fear to have any references to other works in their publications lest it increase sales of books other than their own. A bibliography in this book should have increased the sales and made a more nearly complete book.—Hartley H. T. Jackson.

Nicholes, J. Laurens, "Rodent Specialist." Vandals of the Night. Pasadena, Calif.: Publications Press, pp. 118, pls. 4. 1948. Price $2.50.

In his preface, Mr. Nicholes dedicates his book to "humanity as a weapon of defense in the war of man vs. rats, enlightening the layman to the dangers of the RAT MENACE," and states that he is well qualified to carry the torch in that he is accredited with destroying over 25,000,000 rats. The book is to set forth "everything of importance concerning these dangerous pests . . . and a system of elimination within twenty-four hours."

Now, it is a long time since we have been offered such a panacea, in fact, not since the fantastic claims of the Rodier system or the hullabaloo about the virus that would spread a disease among rodents so that they would die off like flies. Mr. Nicholes' nostrum involves the use of "deodorized, detasted Barium Saltz [sic]" (p. 61) in several types of bait: fresh meat or fish; fruits and vegetables; cereals or cooked stuff; water or milk. "Barium salts," that is, barium carbonate, was tested extensively during the war, and has been discarded by many rodent control agencies as not sufficiently toxic to give reliable control. However, barium carbonate and red squill, according to Mr. Nicholes, are the only poisons that the Bureau of Animal Industry permits in meat packing plants; he has evidently not read of the revision of this rule that allows the use of ANTU (see Du Pont Agric. News Letter, 15 (4): 80, 1947). ANTU is discarded by the author because it is toxic only to the brown rat, and since "not one percent would be pure bred," ANTU would be ineffective.

The intermingling of the species is probably Mr. Nicholes' gravest misapprehension (pp. 8, 13, etc.). He seems not to know that the Norway rat and the black rat are separate, non-interbreeding species, which, to be sure, show color variations. And the biologist does not, as Mr. Nicholes naively suggests (pp. 55–56), "give the technical names of the three different species of rats that comprise what is known as the rat menace, such as Rattus, Rattus rattus,

and Rattus rattus rattus!" Strange that one should have to explain these elementary facts of life to a "rodent specialist"—especially one with 25,000,000 rats hung on his belt.

In several places (pp. 22, 117) Mr. Nicholes states that rats never clean themselves. Captive wild Norways observed in our laboratory in the summer of 1947 spent hours licking and preening themselves and smoothing their fur. To go back to those 25,000,000 rats—perhaps Mr. Nicholes should have studied some of them alive before exterminating them.

The book contains information on the history of rats (including the oft-repeated, but long-discredited, statement of Pallas about the crossing of the Volga in 1727), species, habits, diseases caused by rats, rats in the laboratory, rat-poisoning, rat-proofing, traps (2 pages), rat damage, extermination of lice and fleas (no mention of dimethyl phthallate or DDT), and tells how to conduct a city-wide campaign. There are four plates of poorly-reproduced photographs, mostly borrowed from the U. S. Fish and Wildlife Service.

All in all, the book is packed with biological misconceptions and general misinformation. In the opinion of the reviewer, the layman troubled with rats would better save $2.49 of the $2.50 the book costs, and send his question on a penny postcard to his local agricultural experiment station.—MARGERY P. MANN.

Dalquest, Walter W. MAMMALS OF WASHINGTON. University of Kansas Publications, Museum of Natural History, vol. 2, pp. 1–444, 140 figs., frontis. 1948.

This book is the first comprehensive work on the mammals of Washington. Along with the surveys of Oregon and Idaho and the "Provisional List of Land Mammals of the State of Washington" by Taylor and Shaw, 1929, it serves to complete the general picture of mammal distribution in the northwest.

A relatively large number of mammals evolved in Washington against a background of widely diverse topography, climate, and vegetation. The 230 species and subspecies listed by the author include 23 marine and 207 (10 introduced) land forms. There are 197 living, native land mammals in 6 orders, 20 families, 58 genera, and 101 species.

Dalquest has attempted to correlate the present complex patterns of mammalian distribution with geologic history, particularly the changes wrought by Pleistocene glaciation. Fifty-six pages and two chapters are devoted to "Speculation as to emigrational history of the mammals" and "Speculation as to the later distributional history of the mammals." In this section the author presents what seems to him to be the probable origins and evolution of each species. The hypotheses are frankly labelled speculative, as they should be in the very nature of the case. This emphasis on the dynamic and historical aspects of distribution of the mammals distinguishes this work from other state reports.

The task of reviewing the mammals of Washington was begun as a joint project by Dalquest and Dr. Victor B. Scheffer of the U. S. Fish and Wildlife Service, but was brought to completion by Dalquest. The author examined a considerable number of the mammal specimens from the state, although several important collections were not made use of, notably that of Couch numbering 1200 specimens and the series in the U. M. M. Z.

Introductory chapters on physiographic provinces, distributional areas, climate and vegetation, life zones and ecology, geologic history, faunal affinities, and a check list of the mammals are included in the first part of the book. Dalquest follows the Merriam Life Zone system rather than the ecological classifications advanced by Dice (The Biotic Provinces of North America, Univ. Mich. Press, 1943) and Larrison (Biotic Areas in the Pacific Northwest, Murrelet, 1946).

Each species account includes a description, the range of the species, its relationships within the genus, and brief notes on its habits. In the accounts of races are given citations to the original descriptions, pertinent synonymy, type localities, racial characters, measurements, and, frequently, weights.

The descriptions of subspecies are very brief and in a number of instances would not suffice to identify a specimen. The usefulness of this book to students and others would have been greatly enhanced if identification keys had been included.

The author has contributed many interesting observations based on his considerable field

experience in the state. He has also compiled data from the literature on life histories of the various forms. In a few instances the data may be questioned. For example, in describing the habits of *Tamias* [*Eutamias*] *amoenus*, he states (p. 82) that this chipmunk lives and breeds in the crater of Mount Rainier.

Numerous original photographs (many by Dr. Scheffer) of the mammals and the irhabitats add considerably to the interest of the book. Most of the pictures are fairly well reproduced.

Useful distribution maps of adequate size are shown for nearly all of the species, but they should be interpreted with caution because the ranges shown by the shaded parts of the maps often include areas not indicated by actual specimen records. For example, the alpine areas of the Olympics and Cascades are included in the ranges of mammals which surely do not occur there. In a state as ecologically diverse as Washington assumptions as to distribution are not often justified. Unfortunately the maps are not usually referred to in the text.

The author failed to use available published records in some instances. Thus the indicated range of *Tamias* [*Eutamias*] *amoenus canicaudus*, in eastern Washington, should be extended about 100 miles west in the Columbian Plateau on the basis of specimens recorded by Howell and Larrison. Likewise the map of *Microtus montanus* should include the Grand Coulee area.

The common names employed are generally good, with a few exceptions such as water rat for *Microtus richardsoni* and creeping mouse for *Microtus oregoni*. The name for *Tamias* [*Eutamias*] *amoenus*, yellow pine chipmunk, appears to be original with the author. It happens that yellow pines are rare or absent in a considerable part of the area occupied by this species in Washington.

Dalquest used the generic name *Tamias* instead of *Eutamias* for the western chipmunks and considered *Citellus saturatus* to be a full species rather than a race of *lateralis*, both judgments of doubtful value in my estimation. The least weasel, *Mustela rixosa*, has been recorded from Washington, but there appears no reference to the species in this report. The status of the meadow vole, *Microtus longicaudus mordax*, likewise is not clarified. The two races of *Tamiasciurus douglasii* listed by Taylor and Shaw are recognized as one subspecies, *douglasii*, by Dalquest. All of the Oregon meadow voles in the state are designated as *Microtus o. oregoni*.

The complex relationships of the two races of *Peromyscus maniculatus* in western Washington, *oreas* and *austerus*, are discussed at some length and their ranges reduced to a rather simple pattern by the author. He found that the two forms do not interbreed and that where they do occur in the same area each shows a different habitat preference. It will be interesting to see whether laboratory experiments and further field work corroborate these findings.

In the chapter on distributional history several questionable statements appear. For example (p. 83), "We further suppose that the differences separating the transition area race (*Tamias amoenus affinis*) from the mountain race (*T. a. ludibundus*) came about through natural selection and not as a result of geographic isolation." And in the discussion on *Peromyscus* (p. 91) the author says, "This home-range instinct is essentially a lack of incentive for individual mice to emigrate to new localities where mice of the same species are already established."

The statement that it is generally agreed that a period of about 10,000 years has elapsed since the retreat of the Vashon-Wisconsin glaciers in Washington is also open to question. The proper dating of glaciers is important in regard to the evolution and age of certain races that have developed since the retreat of the ice.

This book presents a description and interpretation of the mammals of Washington that should serve as a basic reference work for naturalists interested in the northwest and will undoubtedly give impetus to future studies in this interesting area.—HAROLD E. BROADBOOKS.

RECENT LITERATURE

(Conducted by Gerrit S. Miller, Jr., Remington Kellogg, and Emma M. Charters)

[Reprints of this section may be purchased from the Corresponding Secretary]

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TWENTY-EIGHTH ANNUAL MEETING

TWENTY-EIGHTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF MAMMALOGISTS

The twenty-eighth annual meeting of the American Society of Mammalogists was held in Toronto, Ontario, Canada, April 11–14, 1948. Meetings were held at the Royal Ontario Museum of Zoology and headquarters were at the Royal York Hotel. Members and guests in attendance numbered 114. The local committee on arrangements for the meeting consisted of: J. R. Dymond, *Honorary Chairman*, R. L. Peterson, *Chairman and Secretary*, S. C. Downing, *Treasurer*, R. M. Anderson, A. W. F. Banfield, C. H. D. Clarke, A. F. Coventry, I. McT. Cowan, E. C. Cross, J. A. Campbell, R. Y. Edwards, C. D. Fowle, A. H. Lawrie, L. S. Russell, L. L. Snyder, and R. H. Stinson.

PROGRAM

SUNDAY, APRIL 11

Registration and Information, Royal York Hotel

8:00 p.m.

Meeting of the Board of Directors, Royal York Hotel

MONDAY, APRIL 12

8:30 a.m.

Registration, Royal Ontario Museum

9:00 a.m.

Morning Session, Museum Theater

Welcome by *Mr. Robert Fennell*, K.C., Chairman, Board of Trustees, Royal Ontario Museum.

Welcome by *Professor J. R. Dymond*, Director, Royal Ontario Museum of Zoology.

Response by *Remington Kellogg* on behalf of the American Society of Mammalogists.

1. The effects of enforced dormancy on *Antrozous pallidus*. *Robert T. Orr*, California Academy of Sciences. Slides.
2. The bacula of some North American vespertilionid bats. *W. J. Hamilton, Jr.*, Cornell University. Slides.
3. Observations on Wisconsin cave bats. *James R. Beer* and *Frederick Greeley*, University of Wisconsin.
4. Do Canadian cave bats migrate? *Harold B. Hitchcock*, Middlebury College.
5. The fur resources of Chapleau District, Ontario, with notes on fur production in the province of Ontario. *Randolph L. Peterson* and *V. Crichton*, Royal Ontario Museum and Ontario Dept. Lands and Forests. Slides.

12:00 Noon

Annual Group Photograph, Museum Entrance

2:00 p.m.

Afternoon Session, Museum Lecture Room 64

6. Arboreal adaptations of mice of the genus *Peromyscus*. *B. Elizabeth Horner*, Smith College. Motion picture.
7. An eight year study of small mammals in Algonquin Park. *Stuart C. Downing*, Royal Ontario Museum of Zoology. Slides.
8. Activity rhythms in a fossorial rodent, *Thomomys talpoides*. *C. A. Tryon, Jr.*, University of Pittsburgh. Slides.
9. Burrows and feeding of the Norway rat. *Rocci G. Pisano* and *Tracy I. Storer*, University of California. Slides.
10. Studies on the steady state of rat populations. *David E. Davis*, Johns Hopkins University. Slides.
11. Wildlife problems that affect National Parks in the United States. *Victor H. Cahalane*, National Park Service, Washington, D.C.

8:00 p.m.

Reception

An informal reception at the Museum was given by the Board of Trustees in honor of the American Society of Mammalogists. The zoology galleries and collections were open for inspection.

TUESDAY, APRIL 13

8:30 a.m.

Morning Session, Museum Theater

12. How to care for and handle porcupines. *Albert R. Shadle* and *Robert Weigel*, University of Buffalo. Motion pictures.
13. A comparative study of traps for rodents. *Tracy I. Storer*, University of California. Slides.
14. The value of accessory lophs and styles in the classification of *Reithrodontomys*. *Emmet T. Hooper*, University of Michigan. Slides.

10:30 a.m.

Museum Lecture Room 64

Annual Business Meeting of the Society; election of officers

2:00 p.m.

Afternoon Session, Museum Lecture Room 64

15. The lower tusks of *Mastodon americanus* and their significance to the feeding habits. *L. S. Russell*, Royal Ontario Museum of Paleontology. Slides.
16. Variation of *Peromyscus maniculatus* in western Washington and adjacent Oregon. *Lee R. Dice*, University of Michigan. Slides.
17. A synopsis of the land mammals of New Hampshire. *Norman A. Preble*, Union College.
18. Some reminiscences of early mammalogists. *R. M. Anderson*, Ottawa.
19. Small mammals of Highlands Plateau. *Eugene P. Odum*, University of Georgia. (Read by title only)
20. Further notes on "An Earlier American Mammal Society." *Hartley H. T. Jackson*, U. S. Fish and Wildlife Service, Washington, D.C.
21. The Emergency Committee for the relief of European mammalogists. *Carolyn S. Murdock*, Washington Court House, Ohio.
22. Kodachromes of an 8-embryo beaver pregnancy. *Albert R. Shadle* and *Robert Weigel*, University of Buffalo. Slides.
23. The male accessory reproductive glands of *Condylura*. *W. Robert Eadie*, Cornell University. Slides.

7:00 p.m.

Annual Banquet, Royal York Hotel

The Annual Dinner was held in the Tudor Room followed by an informal smoker in the Roof Garden, both in the Royal York Hotel.

WEDNESDAY, APRIL 14

8:30 a.m.

Morning Session, Museum Lecture Room 64

24. An unusual abundance of short-tailed shrews, *Blarina brevicauda* (Say). *C. David Fowle* and *R. Y. Edwards*, Ontario Dept. Lands and Forests. Slides.
25. On estimating population from small mammal trapping records. *Don W. Hayne*, Michigan Agricultural Experiment Sta. Slides.
26. A method of census taking based on the home range concept. *D. A. MacLulich*, Ottawa. Slides.

10:00 a.m.

Final Business Meeting of the Society

2:00 p.m.

Afternoon Session, Museum Lecture Room 64

27. The climbing habits of the three-toed sloth. *Arthur Svihla*, University of Washington. (Read by title only)
28. Observation on the young of the bush-tailed cloud rat (*Crateromys schadenbergi*). *Frederick A. Ulmer, Jr.*, Zoological Society of Philadelphia. Slides.
29. Studies on the winter food habits of moose of St. Ignace and smaller adjacent islands, Lake Superior, Ontario. *Randolph L. Peterson*, Royal Ontario Museum of Zoology. Slides.
30. More American support for international wildlife protection. *Antoon de Vos*, Ontario Dept. Lands and Forests.

FIELD TRIP

A field trip was scheduled to Algonquin Park with Mr. C. H. D. Clarke in charge.

BUSINESS MEETINGS

At the meeting of the Board of Directors on April 11, positions were filled by re-appointment as follows: W. Reid Blair, trustee, for the term 1948–1951, and William H. Burt, editor. The Board accepted, with thanks, a contribution toward the expenses of the Society from Dr. Tracy I. Storer. Results of the trial vote on the part of the members during the past year to amend Section 1 of Article VIII of the By-laws of the Constitution showed 383 were in favor of *Annual dues for members shall be four dollars payable in advance*, as compared with 160 opposed. This poll was taken to guide the Board of Directors in recommending such an amendment at the annual meeting and to annouce the amendment in advance of the meeting. This increase in membership dues was originally proposed to cover the cost of membership by the American Society of Mammalogists in the American Institute of Biological Sciences. Because of the increased costs of printing and the financial status of the Society, the Board agreed that membership dues should be increased by one dollar to meet these advances in costs irrespective of membership in the American Institute of Biological Sciences. Since this membership would cost the Society nearly $1000 annually (one dollar per member) the Board made the following decision: "The American Society of Mammalogists is unable to join the American Institute of Biological Sciences on any financial basis other than as an affiliate with an annual contribution of $100 at the present time, due to the financial status of the Society." This $100 shall be taken from operating funds and not from the proposed increase in dues.

At the annual business meeting on April 13, the present officers were re-elected, as follows: Remington Kellogg, president; Lee R. Dice and Tracy I. Storer, Vice-presidents; Robert T. Orr, Recording Secretary; Donald F. Hoffmeister, Corresponding Secretary; and Viola S. Schantz, Treasurer. Directors for the term 1948–1950 were elected as follows: David E. Davis, Kenneth Doutt, Claude W. Hibbard, Randolph L. Peterson, and Albert R. Shadle.

It is with deep regret that the Society learned of the death of six members, one of whom was an honorary (†) member and four of whom were charter (*) members: * H. H. Brimley, * Walter C. Henderson, John Eric Hill, * Robert B. McLain, * Wilfred H. Osgood, † William Berryman Scott.

The corresponding secretary submitted the following summary of membership, subscriptions, and mailing, for the year ending December 31, 1947.

		1946		1947
MEMBERSHIPS				
Changes since preceding annual report				
Nominees		120		125
Resignations	21		23	
Deaths reported	11		6	
Members dropped (delinquent)	13		18	
Total		45		47
Net change		+75		+78
Status as of December 31				
Honorary members	2		3	
Life members	51		51	
Members inactive for duration	54		48	
Annual members (excluding above inactive members)	886		969	
Total membership		993		1071
SUBSCRIPTIONS				
Change since preceding report				
New subscriptions	73		59	
Subscriptions cancelled	19		41	
Net change		+54		+18
Status as of December 31				
Total paid subscriptions		291		309
MAILING LIST				
Total membership	993		1070	
Members not receiving Journal	111		105	
Total members receiving Journal		882		966
Total paid subscriptions		291		309
Total mailing list		1173		1275
Net change from preceding year		+134		+102

Reports of the following standing committees were read and accepted: Editorial, Marine Mammals, Economic Mammalogy and Conservation, Membership. The report of the trustees and special committees on the Index and Check list were read and accepted.

The Board of Directors recommended that the By-laws, Section 1 of Article VIII, read "*Sec.* 1, Annual dues for members shall be four dollars payable in advance." An amendment was then passed to increase the rate for subscription to the Journal of Mammalogy to $5.00 annually.

Two proposed amendments to the Constitution, which amendments will be voted on at the next annual meeting, were made and discussed.

It was proposed that the last sentence of Article II, Section 3, which concerns honorary members, and which reads: "They shall be exempt from all dues and shall be entitled to all privileges of members except that they shall not be eligible to office or to membership on the Board of Directors," should be amended to read: "*They shall be exempt from all dues and shall be entitled to all privileges of members.*"

It was proposed that the By-laws be amended to provide for an increase in cost of life membership from $75 to $100. This amendment to Article VIII, Sec. 2, would read: "*Sec.* 2. *Any member upon payment of one hundred dollars at one time shall be entitled to life membership, and shall be exempt from membership dues.*

RESOLUTIONS

Be it resolved, that the American Society of Mammalogists join with Conservation agencies in opposing the efforts of western stockmen to obtain, by legislation in the United States Congress, ownership or control over public grazing lands of the West. These lands belong to all the people, and it is felt that their continued management by public agencies would best protect and provide for the herds of deer, elk, moose, antelope, and other wildlife species, and for the furture protection of the nation.

Be it resolved, that the American Society of Mammalogists urges the Congress of the United States to maintain the present area of Olympic National Park as being in the best interests of the American people as a whole, and strongly opposes any efforts to reduce the present boundaries of the park.

Be it resolved, that the previously expressed attitude of the American Society of Mammalogists toward the preservation of all species of animal life in Mount McKinley National Park is re-emphasized. In view of the current upward trend in the population of Dall sheep and the downward trend of the wolves to the point of absolute scarcity, the National Park Service is urged to exercise the utmost caution in eliminating additional wolves from the park, and to do so only if the facts indicate that present trends of both species are reversed.

Be it resolved, that the American Society of Mammalogists supports the legislation to complete the acquisition of lands for Everglades National Park (H.R. 3378). It is essential that the lands be acquired and placed under protection as soon as possible. This legislation should require that exploration and prospecting for oil must terminate within five years following acquisition. Subsequent withdrawals of oil must be limited to bonafide commercial operations whose economic value had been proven prior to the end of the exploratory five-year period.

Be it resolved, that the American Society of Mammalogists is strongly opposed to a proposal to erect a dam on the so-called Glacier View site on the North Fork of Flathead River in Montana, which dam would flood a portion of the western side of Glacier National Park. Such flooding would destroy important wilderness values and a large area of winter range for wildlife, and would result in a great reduction in the numbers of large mammals such as moose, white-tail deer, mule deer and elk within the park. Furthermore, the American Society of Mammalogists urges the Secretary of the Interior to use every means at his disposal to avert this threat to the integrity of the park and its important wildlife resources.

Be it resolved, that the American Society of Mammalogists is opposed to the ruthless mass destruction of elk of the southern Yellowstone herd which has occurred through hunting on the floor of Jackson Hole, Wyoming. To avoid a repetition of these mass slaughters during the autumn migrations of the elk, the Society urges that the areas involved, notably Antelope Flat, be held and given protection with Jackson Hole National Monument. The Society urges the Wyoming Game and Fish Commission, in co-operation with the Fish and Wildlife Service, to work out means and measures for controlling the size of the elk herd by public hunting outside of the Monument. Furthermore, the Society urges that the controversy over the Jackson Hole National Monument be settled at once and the area accorded full protection as a unit of the National Park System.

Be it resolved, that the American Society of Mammalogists regards the National Parks as great natural reserves which should be maintained free from commercial exploitation of any kind. In order that original conditions shall be preserved for study and public enjoyment and maximum security afforded for wildlife, domestic livestock should be excluded. No further increases in grazing use should be permitted and present use should be eliminated as rapidly as possible. The grazing of saddle and pack stock should be held to the absolute minimum required by administrative and visitor needs.

Be it resolved, that the American Society of Mammalogists urges that the government of the Dominion of Canada adopt measures of protection for the gray seals at the mouth of the

Bay of Fundy, including the prohibition of the shooting of gray seals in and about the Grand Manan archipelago and the shooting of all seals at and near North Rock and Murr Ledges. The Society also urges the Dominion Department of Fisheries to initiate as soon as possible a thorough study of the economic effects of all seals on the eastern coast of Canada, in order to determine whether the destruction of seals and the payment of bounties on seals, need be continued.

Reports coming from Alaska indicate that since World War II there has been an alarming decrease in big game numbers with the exception of moose.

Therefore, be it resolved, that the American Society of Mammalogists recommends strongly that the Fish and Wildlife Service determine the possible causes of the decline, to obtain information on the present status of the large mammals, and to provide measures for their adequate protection and preservation.

Be it resolved, that the American Society of Mammalogists at its 28th Annual Stated Meeting extends to the Ontario Department of Lands and Forests, the Toronto Field Naturalist Club, the Fur Trade Association of Canada, Inc., the Museum of the Province of Quebec, the Hudson's Bay Company, the T. Eaton Co., Ltd., and to numerous other friends of the Museum its sincere appreciation for the generous way in which they have contributed to the success of this Annual Meeting.

Be it resolved, that the American Society of Mammalogists at its 28th Annual Stated Meeting extends to the University of Toronto, the Royal Ontario Museum of Zoology, and to the Local Committee, especially Professor J. R. Dymond, R. L. Peterson, S. C. Downing, and C. D. Fowle, its thanks and hearty appreciation for providing the facilities and entertainment which have contributed so largely to the success of the meetings and the enjoyment of the attending members.

LIST OF MEMBERS

LIST OF MEMBERS OF THE AMERICAN SOCIETY OF MAMMALOGISTS

(Additions have been made to this list to May 1, 1948. Corrections and changes of addresses should be sent to the Corresponding Secretary—Donald F. Hoffmeister)
*Life Member †Nominee for Annual Member

Honorary Members

ANDERSON, RUDOLPH M., 58 Driveway, Ottawa, Canada.....(Charter) 1947
CABRERA, ANGEL, Calle 64, no. 584, La Plata, Argentine.....(Charter) 1947
MILLER, GERRIT S., JR., U. S. National Museum, Washington 25, D. C.....(Charter) 1941

Life Members and Annual Members

ADAMS, CHARLES C., 149 Manning Blvd., Albany 3, N. Y.....Charter
ADAMS, I. C., JR., 3 N. Glenwood, Columbia, Mo..... 1941
ADAMS, LOWELL, Forest Experiment Sta., Missoula, Mont..... 1938
ADAMS, WILLIAM C., Dept. Conservation, Arcade Office Bldg., Albany, N. Y..... 1933
AGACINO, E. MORALES, Instituto Espanol de Entomologia, Museo Nacional de Ciencias Naturales Hipodromo, Madrid, Spain..... 1933
*ALCORN, J. R., Rt. 1, Box 19a, Fallon, Nev..... 1939
ALDERSON, LOUIS EVERETT, 910 Stanton, Morgantown, W. Va..... 1947
ALDOUS, CLARENCE M., Fish & Wildlife Service, P.O. Box 1306, Albuquerque, N. M.... 1931
ALDOUS, SHALER E., Fed. Aid Div., Fish & Wildlife Service, Washington, D. C.... 1927
*ALEXANDER, MISS ANNIE M., Suisun, Calif.....Charter

ALEXANDER, MAURICE, Dept. Forest Zoology, N. Y. State Coll. of Forestry, Syracuse 10, N. Y. 1947
ALLAN, PHILIP F., 1801 Carlton, Ft. Worth, Tex. 1931
ALLEN, ARTHUR A., Fernow Hall, Ithaca, N. Y. ..... Charter
ALLEN, DURWARD L., Patuxent Refuge Reserve, Laurel, Md. 1938
†ALLEN, GEORGE W., State Game & Fish Com., 412 State Capitol, Atlanta, Ga. 1948
ALLIN, A. E., Provincial Lab., Ft. William, Ontario 1942
ALLRED, WARREN J., Afton, Wyoming 1946
AMADON, DEAN, Amer. Mus. Nat. Hist., New York 24, N. Y. 1938
AMUNDSON, GENO A., Sheldon Nat'l. Antelope Refuge, Cedarville, Calif. 1942
ANDERSON, JOHN M., P.O. Box 128, Port Clinton, Ohio 1939
ANTHONY, H. E., Amer. Mus. Nat. Hist., New York 24, N. Y. ..... Charter
†ARCHBALD, DAVID, 172 Linwood Ave., Buffalo 9, N. Y. 1948
*ARCHBOLD, RICHARD, Amer. Mus. Nat. Hist., New York 24, N. Y. 1929
ARNOLD, LEE W., 546 Custom House, Denver, Colo. 1940
ATZ, JAMES W., 697 Tremont Ct., Orange, N. J. 1936
AUSTIN, OLIVER L., SR., Tuckahoe, Westchester Co., N. Y. 1930
AXTELL, HAROLD H., Buffalo Mus. Science, Buffalo 11, N. Y. 1945
BACHRACH, MAX, 370–7th Ave., New York 1, N. Y. 1947
BAILEY, ALFRED M., Colorado Mus. Nat. Hist., Denver, Colo. ..... Charter
BAILEY, HAROLD H., Box 6333, 820 Alhambra Circle, Coral Gables, Fla. ..... Charter
*BAILEY, JOHN W., 27 Willway Rd., Richmond 21, Va. 1927
BAILY, FISHER C., 1229 Ralston St., Reno, Nev. 1945
*BANNON, HENRY, First Nat'l Bank Bldg., Portsmouth, Ohio 1922
BAKER, JOHN H., 1165 Fifth Ave., New York, N. Y. 1941
BAKER, ROLLIN H., Mus. Nat. Hist., Univ. Kansas, Lawrence, Kans. 1938
BALDWIN, PAUL H., Mus. Vert. Zool., Univ. California, Berkeley 4, Calif. 1941
BALDWIN, S. GLIDDEN, 139 N. Vermillion St., Danville, Ill. 1945
BALDWIN, WILLIAM P., JR., Savannah National Wildlife Refuge, Port Wentworth, Ga. 1939
†BALMER, CHARLES V. B., 309 Armstrong Rd., Hampton, Va. 1948
BANFIELD, A. W. FRANK, Dom. Wildlife Service, Dept. Mines & Resources, Ottawa, Canada 1938
BANTA, BENJAMIN H., P.O. Box 605, Reno, Nev. 1942
BARBOUR, ROGER WILLIAM, 109 Barbour Ct., Morehead, Ky. 1941
†BARD, FRED G., Provincial Mus., Regina, Saskatchewan, Canada 1948
BARKALOW, FREDERICK S., JR., Box 5215, State College Station, Raleigh, N. C. 1934
BARNES, CLAUDE T., 359–10th Ave., Salt Lake City, Utah ..... Charter
BARNES, WILLIAM B., 10 State House Annex, Indianapolis, Ind. 1942
BARRETT, CHARLES H. M., 1339 Valley Pl., S.E., Washington 20, D. C. ..... Charter
BARRINGTON, B. A., Fort Barrancas Sta. Hosp., Fla. 1940
BARTHOLOMEW, GEORGE A., JR., Dept. Zool., U.C.L.A., Los Angeles 24, Calif. 1942
BARTO, ELIZABETH, Lab. Vert. Biol., Univ. Michigan, Ann Arbor, Mich. 1938
BARTSCH, PAUL, "Lebanon," Lorton, Va. 1921
BATCHELDER, CHARLES F., 7 Kirkland St., Cambridge, Mass. ..... Charter
BATES, MARSTON, The Rockefeller Foundation, Apartado 2508, Bogota, Colombia. 1944
BATTS, H. LEWIS, JR., 4930 Washtenaw Rd., Ypsilanti, Mich. 1947
*BAUMGARTNER, LUTHER, B. F. Goodrich Co., Boyce Thomson Inst., Yonkers, N. Y. 1937
BAXTER, WILLIAM, JR., 1018 Trenton Place, Wilmington, Del. 1942
BEACH, FRANK A., Dept. Psychol., Yale Univ., New Haven, Conn. 1947
BEACH, JAMES E., 79 Oakgrove Dr., Williamsville 21, N. Y. 1946
*BEACH, WILLIAM N., Room 1518, 551 Fifth Ave., New York, N. Y. ..... Charter
BEAN, ROBERT, Chicago Zool. Park, Brookfield, Ill. 1946
BEARD, DANIEL B., Box 275, Homestead, Fla. 1935

BECKER, EDWIN J., 123 S. Harvard, Albuquerque, N. M. 1946
BEEBE, WILLIAM, 33 W. 67th St., New York, N. Y. ..... Charter
BEECHER, WILLIAM J., Chicago Nat. Hist. Mus., Chicago 5, Ill. 1947
BEER, JAMES R., Dept. Wildlife Mgt., 424 Univ. Farm Pl., Madison 6, Wisc. 1940
BEHLE, WILLIAM H., Dept. Biol., Univ. Utah, Salt Lake City, Utah 1936
BELLROSE, FRANK C., JR., Ill. Nat. Hist. Survey, Havana, Ill. 1941
BENCHLEY, BELLE J., Zoological Garden, San Diego, Calif. 1942
BENNETT, LOGAN J., Fish & Wildlife Service, 2248 Interior Bldg., Washington, D. C. 1939
BENNETT, MARY A., Western Ill. State Coll., Macomb, Ill. 1947
BENNINGTON, ELWIN E., Kelly, Iowa 1941
BENNITT, RUDOLF, 106 Wildlife Conserv. Bldg., Univ. Missouri, Columbia, Mo. 1937
BENSON, SETH B., Mus. Vert. Zool., Univ. Calif., Berkeley 4, Calif. 1928
BERGER, ANDREW J., Dept. Zool., Univ. Michigan, Ann Arbor, Mich. 1942
BEULE, JOHN D., 312 W. 3rd St., Beaver Dam, Wisc. 1939
BIDDLE, JOHN A., 16811 Fernway Rd., Shaker Heights 20, Ohio 1945
BILADEAU, TED D., % Atlanta Stage, Boise, Idaho 1946
†BINGHAM, LaRAY G., 2068 Madison, Ogden, Utah 1948
BIRDSEYE, CLARENCE, Eastern Point Blvd., Gloucester, Mass. 1933
BISHOP, SHERMAN C., Dept. Biol., Univ. Rochester, Rochester, N. Y. ..... Charter
BLACK, GEORGE O., Cornell Rd. R #1, Box 227, Oswego, Oregon 1941
BLAIN, ALEXANDER W., 2201 Jefferson Ave., E. Detroit, Mich. 1926
BLAIR, W. FRANK, Dept. Zool. & Physiol., Univ. Texas, Austin, Tex. 1936
BLAIR, W. REID, 271 College Rd., Riverdale, New York, N. Y. 1927
BLANC, FRANCOIS E., Blvd. Maillot 42, Neuilly Sur Seine, France 1946
BLOSSOM, PHILIP M., 2737½ W. 15, Los Angeles 6, Calif. 1929
BLUNTSCHLI, HANS, Dir. Anat. Inst., Univ. Bern, Aebistrasse 9, Bern, Switzerland. 1930
BLYTH, DAVID, 2337 Angler Rd., Columbus 11, Ohio 1939
†BOATMAN, PAUL A., 902 E. Wabash Ave., Carthage, Ill. 1948
BOEHM, EARL W., 315 Albert Ave., East Lansing, Mich. 1946
*BOLE, BENJAMIN P., JR., Cleveland Mus. Nat. Hist., 2717 Euclid Ave., Cleveland, Ohio 1930
BOLT, BENJAMIN F., 1110 Armour Blvd., Kansas City, Mo. ..... Charter
BOND, RICHARD M., 3322 S.W. Fairmount Blvd., Portland, Oregon 1938
BONHAM, KELSHAW, 5240 18th Ave., Seattle 5, Wash. 1942
BOOTH, ERNEST S., Walla Walla College, College Pl., Wash. 1941
*BORDEN, JOHN, Box 442, Muskegon, Mich. 1928
BORELL, ADREY E., Soil Conservation Ser., P.O. Box 1348, Albuquerque, N. Mex. 1925
BOULWARE, JEAN T., 428 Livingston, Madison 3, Wisc. 1941
BOWDISH, BEECHER S., Demarest, N. J. 1921
BOYCE, ARLOW P., D-7 Wells Hall, Michigan State Coll., East Lansing, Mich. 1947
BOYER, GEORGE F., P.O. Box 60, Apt. 6, York St., Sackville, N. B., Canada 1947
BOYER, RICHARD H., Sequoia Nat'l Park, Calif. 1929
BRADT, G. W., Box 386, Rt. 1, East Lansing, Mich. 1927
BRANDBORG, STEWART M., 715 S. 3rd, Hamilton, Mont. 1946
*BRANDRETH, COURTENAY, Ossining, N. Y. 1921
BRAY, ROBERT S., R.F.D. 2, Herndon, Va. 1939
BRECKENRIDGE, W. J., Mus. Nat. Hist., Univ. Minn., Minneapolis, Minn. 1932
BRITTAN, MARTIN R., Nat. Hist. Mus., Stanford Univ., Palo Alto, Calif. 1947
BROADBOOKS, HAROLD E., Mus. Zool., Univ. Mich., Ann Arbor, Mich. 1939
BROHN, ALLEN, 110 Wildlife Cons. Bldg., Columbia, Mo. 1945
*BROOKE, RAYMOND J., JR., 609 Woodcrest Ave., Ardmore, Penna. 1944
BROOKS, EARLE A., 166 Plymouth Rd., Newton Highlands, Mass. 1921
BROOMAN, RONALD C., % Bank of Montreal, Kitchener, Ontario 1938
BROWN, CHARLES P., 15 Union Ave., Slingerlands, N. Y. 1939

BROWN, ELMER E., Box 97, Davidson, N. C. 1944
BROWN, F. MARTIN, Fountain Valley School, Colorado Springs, Colo. 1926
BROWN, LOUIS G., Box 36, Griggsville, Ill. 1940
BROWN, N. RAE, Faculty of Forestry, Univ. New Brunswick, Fredericton, N.B., Canada 1946
BROWN, V. E., Dept. Zool., Marquette Univ., Milwaukee, Wisc. 1942
BRUCE, WILLIS H., Gladstone, Ore. 1946
BRUNSON, LAWRENCE W., 6415 Illinois St., Houston 4, Tex. 1946
BRYANT, FRANKLYN A., Waterton Park, Alberta, Canada 1939
BRYANT, HAROLD C., Grand Canyon, Ariz. ..... Charter
BRYANT, MONROE D., 910 W. Gandy St., Denison, Tex. 1940
BUCHER, G. C., Box 395, Maitland, Fla. 1936
BUCK, D. H., 115 W. Gandy St., Denison, Tex. 1946
BUCK, ELLSWORTH B., Pier 23, Rosebank, Staten Is., N. Y. 1940
BUCKLEY, JOHN L., New York State College of Forestry, Syracuse, N. Y. 1946
BUECHNER, HELMUT K., Dept. Wildlife Mgt., Okla. A & M College, Stillwater, Okla. 1945
BULLOCK, D. S., Casilla 2-D, Angol, Chile 1921
BURES, JOSEPH A., 2316 Hayson Ave., Pittsburgh 16, Penna. 1944
BURGESS, THORNTON W., 61 Washington Rd., Springfield, Mass. ..... Charter
BURKE, MELVIN H., U. S. Forest Service, Enterprise, Ore. 1946
BURMEISTER, MELVIN, 6143 Melrose St., Chicago, Ill. 1938
BURROUGHS, R. D., Game Division, Dept. Conservation, Lansing 13, Mich. 1938
BURT, WILLIAM H., Mus. Zool., Univ. Michigan, Ann Arbor, Mich. 1926
BUSS, IRVEN O., 1101 3rd St., Menomonie, Wisc. 1941
BUTSCH, ROBERT S., Mus. Zool., Univ. Michigan, Ann Arbor, Mich. 1946
CABOT, WILLIAM B., 447 Marlboro St., Boston, Mass. 1922
CADE, THOMAS J., 1109 Marion Dr., Glendale, Calif. 1947
CADWALADER, CHARLES M. B., Ft. Washington, Penna. 1930
*CADWALADER, W. B., 133 S. 36th St., Philadelphia, Penna. 1924
CAGLE, FRED R., Dept. Zool., Tulane Univ., New Orleans, La. 1942
CAHALANE, VICTOR H., Nat'l Park Service, So. Interior Bldg., Washington 25, D. C. 1930
CALHOUN, JOHN B., Dept. Parasit., Rodent Ecol. Proj., Johns Hopkins Univ., Baltimore 5, Md. 1940
CAMPBELL, BERRY, Univ. Minn. Medical School, Minneapolis, Minn. 1934
CAREY, JOSHUA H., Dept. Surgery, Univ. Chicago, Chicago 37, Ill. 1945
CARR, WILLIAM H., 1708 N. Santa Rita, Tucson, Ariz. 1926
CARROLL, MITCHEL, Franklin & Marshall College, Lancaster, Penna. 1922
CARTER, BRIAN C., Northwestern Wildlife Sta., Univ. New Brunswick, Fredricton, N.B., Canada 1947
CARTER, T. DONALD, Amer. Mus. Nat. Hist., New York 24, N. Y. 1922
CASAMAJOR, LOUIS, 706 W. 168th St., New York 32, N. Y. 1922
CASE, JAMES F., Dept. Biol., Johns Hopkins Univ., Baltimore 18, Md. 1945
CASEY, GARRY F., 825 S. 6th St., Burbank, Calif. 1947
CASSEL, J. FRANK, Dept. Zool., Colo. A & M College, Ft. Collins, Colo. 1944
CASTLE, WILLIAM E., Hilgard Hall, Univ. Calif., Berkeley, Calif. 1930
CHAMBERLAIN, EDWARD B., The Charleston Museum, Charleston 16, S. C. 1923
CHAMBERS, CHARLES M., JR., 5607-5 NE, Seattle, Wash. 1946
CHAPIN, JAMES P., Amer. Mus. Nat. Hist., New York 24, N. Y. ..... Charter
CHAPMAN, ARTHUR O., Dept. Anat., Univ. Kansas, Lawrence, Kans. 1946
CHAPMAN, FLOYD B., 1944 Denune Ave., Columbus 11, Ohio 1937
CHASE, HENRY B., JR., 517 Decatur St., New Orleans, La. 1924
CHASE, WARREN W., School of Forestry & Cons., Univ. Michigan, Ann Arbor, Mich. 1945
CHEATUM, E. LEONARD, R.D. 1, Delmar, N. Y. 1947
CHEESMAN, WILLIAM H., U. S. Plant Industry Station, Beltsville, Md. ..... Charter

CHEW, ROBERT M., Vivarium Bldg., Univ. Illinois, Champaign, Ill..... 1946
CHIQUOINE, A. DUNCAN, Stimson Hall, Cornell University, Ithaca,N. Y..... 1947
CHRISTIAN, JOHN J., 12 Roseland Ave., Fox Chase Manor, Philadelphia 11, Penna..... 1944
CHURCH, MORTON L., 1626 Queens Rd. West, Charlotte, N. C.....Charter
CIRILLO, VINCENT, % Dept. Biology, Univ. Buffalo, Buffalo 14, N. Y..... 1946
CLARK, EDGAR W., 1520 S. 53rd St., Apt. 1R, Richmond, Calif..... 1945
CLARK, JAMES L., Amer. Mus. Nat. Hist., New York 24, N. Y..... 1926
†CLARK, KIM, Mus. Nat. Hist., Univ. Kansas, Lawrence, Kans..... 1948
CLARK, WILLIAM K., 5 Westwood, Mobile 18, Ala..... 1946
CLARKE, C. H. D., Royal Ontario Mus. Zool., Toronto, Canada..... 1938
†CLARKE, ELMER B., 184 Allenhurst, Buffalo 14, N. Y..... 1948
†CLAY, WILLIAM M., Dept. Biol., Univ. Louisville, Louisville 8, Ky..... 1948
COBB, W. MONTAGUE, Dept. Anat., Howard Univ., Washington 1, D. C..... 1933
COCKRUM, E. LENDELL, Mus. Nat. Hist., Univ. Kansas, Lawrence, Kans..... 1945
†COHEN, RONALD S., 24 Homer Ave., Buffalo, N. Y..... 1948
COLBERT, EDWIN H., Amer. Mus. Nat. Hist., New York 24, N. Y..... 1930
*COLBURN, ALBERT E., 3100 Wilshire Blvd., Los Angeles, Calif.....Charter
COLE, JAMES E., 424 S. 35 St., Apt. 3, Omaha 3, Nebr..... 1947
COLEMAN, ROBERT H., Rt. 5, Box 615, Charleston, S. C..... 1928
*COLTON, HAROLD S., Box 127, Flagstaff, Ariz..... 1927
COMPTON, LAWRENCE V., Soil Cons. Service, Box 1898, Ft. Worth 1, Tex..... 1929
CONAWAY, CLINTON H., Dept. Zool., Mont. State Univ., Missoula, Mont..... 1947
CONISBEE, L. R., 10 Baldslow Rd., Hastings, England..... 1936
†CONNELL, JOSEPH H., International House, Berkeley 4, Calif..... 1948
CONSTANTINE, DENNY G., 4049 Sunset Dr., Los Angeles 27, Calif..... 1942
COOK, ARTHUR H., 9 Fernbank Ave., Delmar, N. Y..... 1939
COOK, DAVID B., 14 Nolan Rd., Albany 5, N. Y..... 1940
COOK, FANNYE A., 1119 Pinehurst, Jackson, Miss..... 1925
COOLIDGE, HAROLD J., JR., 3106 Cleveland Ave., Washington 8, D. C..... 1926
COPE, JAMES B., Earlham College, Richmond, Ind..... 1943
COPELAND, MANTON, Bowdoin College, Brunswick, Me.....Charter
†COPPEDGE, CHARLES A., Denbigh, Va..... 1948
COTTAM, CLARENCE, Fish & Wildlife Serv., Interior Bldg., Washington 25, D. C.... 1929
COUCH, LEO K., Fish & Wildlife Serv., Interior Bldg., Washington 25, D. C.....Charter
COUFFER, JACK, 2041 El Arbolita Dr., Glendale 8, Calif..... 1941
COURTNEY, R. J., Bures, Somaliland Protectorate, Africa..... 1946
COURTNEY, THOMAS J., 208 Inglis St., Halifax, Nova Scotia, Canada..... 1947
COVENTRY, A. F., Dept. Biol., Univ. Toronto, Toronto 5, Canada..... 1935
COWAN, IAN MC., Dept. Zool., Univ. British Columbia, Vancouver, B. C..... 1933
COX, MILO L., Box 125, Encino, Tex..... 1947
CRABB, WILFRED D., Box 1381, Fish & Wildlife Serv., River Basin Studies, Billings, Mont..... 1940
CRANDALL, LEE S., N. Y. Zoological Park, New York, N. Y..... 1922
CRESPO, JORGE A., G. Campos y S. Moron, Bella Vista, F.C.P., Prov. Bs. Aires, Argentina..... 1947
CREW, HENRY E., JR., Box 1974, College Station, Tex..... 1946
CRICHTON, VINCENT, Chapleau, Ontario, Canada..... 1948
CRIDDLE, STUART, Treesbank, Manitoba, Canada.....Charter
†CRITCHER, T. STUART, 301 Smithwick St., Williamston, N. C..... 1948
CRONEMILLER FRED P., U.S.F.S., 630 Sansome St., San Franciso, Calif..... 1947
CROSS, E. C., Royal Ontario Mus. Zool., Toronto, Ont., Canada..... 1936
CULBERTSON, A. E., Dept. Biol., Fresno State College, Fresno, Calif..... 1938
*CUTTING, CHARLES S., 32 Nassau St., New York, N. Y..... 1930
DALE, FREDERICK H., Dept. Conservation, Game Div., Lansing, Mich..... 1935

DALKE, PAUL D., Fish & Wilflife Serv., Univ. Idaho, Moscow, Idaho 1928
DALQUEST, WALTER W., 6521-17th NE, Seattle, Wash 1937
DAMON, DAVID, Game, Forestation, and Parks Comm., Lincoln, Nebr 1934
DARBY, ROLLO E., P.O. Box 187, 210 Main St., Wheatland, Calif 1941
DARROW, ROBERT W., 7 Rural Pl., Delmar, N. Y 1932
†DASMANN, RAYMOND F., 1815 Sonoma Ave., Berkeley 7, Calif 1948
DAVEY, WINTHROP N., Univ. Hospital, Ann Arbor, Mich 1944
DAVIS, D. DWIGHT, Chicago Nat. Hist. Mus., Chicago 5, Ill 1930
DAVIS, DAVID E., School of Hygiene & Pub. Health, Johns Hopkins Univ., Baltimore 5, Md 1936
DAVIS, D. H. S., Plague Research Lab., Dept. Health, P.O. Box 1038, Johannesburg, S. Africa 1937
DAVIS, GEORGE W., 148 Northfield St., Montpelier, Vt 1935
DAVIS, JOHN, Mus. Vert. Zool., Univ. Calif., Berkeley 4, Calif 1942
†DAVIS, JOSEPH A., JR., 294 Webster Ave., Jersey City 7, N. J 1948
*DAVIS, WILLIAM B., Dept. Wildlife Mgt., Texas A & M College, College Station, Tex ... 1934
DAWSON, EVERETT T., Game, Fish, & Oyster Commission, Walton Bldg., Austin 14, Tex 1944
DAY, ALBERT M., Fish & Wildlife Serv., Interior Bldg., Washington 25, D. C 1924
DEGERBOL, M., Universitets Zoologiske Mus. Krystalgade, Kobenhavn, Denmark ... 1946
DEICHMANN, ELIZABETH, Mus. Comp. Zool., Harvard Univ., Cambridge, Mass 1925
DE LORME, ROBERT, 314 Stevens Bldg., Portland, Ore 1945
DE LURY, RALPH E., 330 Fairmont Ave., Ottawa, Ontario, Canada 1925
DE MEULES, DONALD H., 2216 Thomas Ave. N., Minneapolis 11, Minn 1947
DEMING, OSCAR V., RR #1, Box 14, Las Vegas, Nev 1943
DENYES, HELEN ARLISS, Lab. Vert. Biol., Univ. Mich., Ann Arbor, Mich 1946
DE VOS, ANTOON, % Regional Forester, Dept. Lands & Forests, Port Arthur, Ontario, Canada 1948
DEXTER, RALPH W., Dept. Biol., Kent State Univ., Kent, Ohio 1946
DICE, LEE R., Lab. Vert. Biol., Univ. Mich., Ann Arbor, Mich ..... Charter
DIEBOLD, FRANCES, Dept. Biol., Kalamazoo College, Kalamazoo, Mich 1947
DILLE, FREDERICK M., 822 Grand Ave., Nogales, Ariz ..... Charter
DILLEHUNT, HARRY B., JR., 214 W. Read St., Baltimore, Md 1926
DILLON, OLAN WILLIAM, JR., P.O. Box 811, Seguin, Tex 1944
DIRKS-EDMONDS, CLAIRE, Box 111, McMinnville, Ore 1941
DIXON, JOSEPH, Star Rt., Box 357, Escondido, Calif ..... Charter
DIXON, KEITH LEE, Mus. Vert. Zool., Univ. Calif., Berkeley 4, Calif 1947
DOBIE, J. FRANK, 702 Park Place, Austin, Tex 1948
DOLAN, THOMAS, Umbrella Farm, Kulpsville, Penna 1948
DOLE, SUMNER A., JR., 19 Tahanto St., Concord, N. H 1947
DOUTT, J. KENNETH, Carnegie Museum, Pittsburgh, Penna 1927
DOWNING, S. C., Royal Ontario Mus. Zool., Toronto 5, Ontario, Canada 1945
†DOWNS, THEODORE, Mus. Paleontology, Univ. Calif., Berkeley 4, Calif 1948
DOZIER, HERBERT L., U. S. Fur Animal Field Station, Blackwater Refuge, Cambridge, Md 1940
DREYER, MRS. OLIVER, Box 270, Texarkana, Ark 1939
DUNK, F. A., 260 Leopold Crescent, Regina, Saskatchewan, Canada 1929
DUNN, E. R., Haverford College, Haverford, Penna 1927
DURRELL, JAMES S., RR #4, Wills Point, Tex 1942
DURHAM, FLOYD E., 3314 Mesa Dr., San Gabriel, Calif 1938
DURRANT, STEPHEN D., Dept. Zool., Univ. Utah, Salt Lake City, Utah 1934
DUSTMAN, EUGENE H., 110-12th Ave., Columbus 1, Ohio 1945
EADIE, W. ROBERT, Stimson Hall, Cornell Univ., Ithaca, N. Y 1936
†EARLE, JAMES B., Rt. #2, Box 59x, Gainesville, Fla 1948

†Easton, Delbert G., Greenup, Ill. 1948
Eastwood, Sidney K., 5110 Friendship Ave., Pittsburgh 24, Penna. 1929
†Eaton, Paul A., 585 W. Delavan Ave., Buffalo 13, N. Y. 1948
Eaton, Theodore H., Jr., Southwestern College, Winfield, Kans. 1947
Edge, Mrs. Charles N., 1215–5th Ave., New York, N. Y. 1930
Edminster, Frank C., 312 Lincoln Ave., Lansdowne, Penna. 1938
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FRUM, W. GENE, 640 N. High St., Morgantown, W. Va..... 1941
FRYE, O. E., JR., Box 834, Punta Gorda, Fla..... 1946
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INGRAM, WILLIAM M., Dept. of Zool., Mills College, Oakland 13, Calif. ... 1940
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KERN, CHARLES W., 4015 Charles St., La Mesa, Calif. 1944
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KINNEY, WARREN W., Lee's Hill Farm, New Vernon, P.O. Morristown, N. J. 1944
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LINSDALE, JEAN M., Jamesburg Route, Monterey, Calif. . . . 1921
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LLOYD, A. C., 6710 Frankstown Ave., Pittsburgh 8, Penna. . . . 1946
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LONGHURST, WILLIAM, 5500 Sonoma Hwy., Napa, Calif. . . . 1940
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LOWER, BILL R., 638 S. Duncan Ave., Los Angeles 22, Calif. . . . 1946
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MCGREGOR, JAMES H., Columbia Univ., New York 27, N. Y. . . . 1927
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McMillan, I. I., Box 63, Shandon, Calif. 1948
McMillan, John F., 1106 Oakland, Ann Arbor, Mich. 1946
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†McQuain, Robert G., 1026 Brook St., Louisville, Ky. 1948
MacMullan, R. A., Game Div., Dept. Cons., Lansing, Mich. 1944
McMurry, Frank B., % Delamart Food Shop, 2733 Hollister St., Santa Barbara, Calif. 1936
Macnab, James A., Dept. Biol., Linfield College, McMinnville, Ore. 1941
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Maloney, John E., Dept. Zool., Univ. Minnesota, Minneapolis 14, Minn. 1947
*Mann, William M., Nat'l Zool. Park, Washington 25, D. C. 1926
Mann F., Guillermo, Calle Ladislao Errazuriz 2157, Santiago, Chile 1945
Manning, Thomas H., 37 Linden Terrace, Ottawa, Ontario, Canada 1944
Mansfield, George S., P.O. Box 385, Atascadero, Calif. 1942
Manville, Richard H., Dept. Zool., Michigan State College, East Lansing, Mich. 1939
Marcotte, L'Abbe L., Seminaire St. Charles, Sherbrooke, Quebec, Canada 1925
†Marion, Frederic A., 185 Woodward Ave., Buffalo 14, N. Y. 1948
Markley, Merle H., 404 B. St., N.E., Washington, D. C. 1941
Marks, Eugene M., 2203 Fillmore Ave., Buffalo 14, N. Y. 1942
Marshall, William H., Div. Entom. & Econ. Zool., Univ. Farm, St. Paul 8, Minn. 1936
Martinez, Liborio, Mar de China No. 14, Tacuba, D. F., Mexico 1944
Maslowski, Karl H., 1034 Maycliff Pl., Cincinnati 30, Ohio 1947
Mason, Charles I., Wildlife Research Lab., Delmar, N. Y. 1945
Massmann, William H., 49 Tanner Ave., Willimantic, Conn. 1948
Mather, Deane W., 817 Laurel, Ocala, Fla. 1930
Matson, J. R., 76 Lake St., Perry, N. Y. 1946
Matthews, L. Harrison, Dept. Zool., Univ. Bristol, England 1946
Mayall, Kenneth M., R. R. 3, Weston, Ontario, Canada 1947
Meacham, Frank B., State Museum, Raleigh, N. C. 1947
Medcalf, Robert, 2606 S.E. 81st Ave., Portland 6, Ore. 1944
Merkle, Jess M., Rt. 3, Box 336A, Madera, Calif. 1945
Merrill, Howard A., Storrs, Conn. 1938
Metcalf, Z. P., North Carolina State College, Raleigh, N. C. ..... Charter
†Meyer, Darrell S., 1705 Anthony, Columbia, Mo. 1948
Meyer, Gardiner H., 16–50 Bell Blvd., Bayside, Long Island, N. Y. 1939
Meyer, Patricia Ann, 438 Northampton St., Buffalo 8, N. Y. 1945
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Mickey, Arthur B., 1516 Rainbow Ave., Laramie, Wyo. 1947
Miller, Alden H., Mus. Vert. Zool., Univ. Calif., Berkeley 4, Calif. 1930
Miller, Douglass S., 122 Lawrence Ave., East, Toronto, Ontario, Canada 1947
Miller, Frederic W., 2911 Farine Pl., Dallas 11, Tex. 1921
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Miller, Robert C., Calif. Acad. Sciences, San Francisco, Calif. 1938
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Miller, Thomas, 1809 Bushnell Ave., South Pasadena, Calif. 1941
Mills, Herbert R., 706 Franklin St., Tampa 2, Fla. 1941
Mills, Robert H., 2466 Medary Ave., Columbus 2, Ohio 1942
Mirand, Edwin A., 280 Lisbon, Buffalo 15, N. Y. 1947

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†MITCHELL, SYDNEY, 3306 Washington Ave., Newport News, Va 1948
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MOHR, CHARLES E., Audubon Nature Center, R.D. 4, Greenwich, Conn 1932
MONDOLFI, EGARDO, Edificio Altamira #2A, Avenida Altamira, San Bernardino, Caracas, Venezuela 1944
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MOORE, A. W., 673 E. Main St., Hillsboro, Ore 1921
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†MOORE, GALEN, III, 227 53rd St., Newport News, Va 1948
*MOORE, JOSEPH C., 170 Flavet Village II, Gainesville, Fla 1941
MOORE, MARTHA, 27 Eastover Ct., Louisville, Ky 1942
MOORE, ROBERT T., Meadow Grove Pl., Pasadena 2, Calif 1926
MOREJOHN, GONZALO, JR., Los Angeles County Mus., Exposition Pk., Los Angeles 7, Calif 1946
MORRIS, HUBERT F., 28 Glenjowan Rd., Toronto, Ontario, Canada 1946
MOSSMAN, HARLAND W., Science Hall, Univ. Wisconsin, Madison, Wisc 1930
MUNRO, HARRIET E., 184 Bayview Ave., Toronto, Ontario, Canada 1948
MURDOCK, MRS. DONALD R., Lindbergh Ave. & McLeon St., Washington Court House, Ohio 1930
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MURIE, ADOLPH, McKinley Park, Alaska 1924
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MURRAY, LEO T., 1602 Ridgecrest Dr., Albuquerque, New Mex 1936
NADLER, CHARLES F., 602 Spruce St., Winnetka, Ill 1947
NAGEL, OTTO, R.F.D. #1, Sigourney, Iowa 1945
NECKER, WALTER L., 6843 Hobart Ave., Chicago 31, Ill 1936
NEGUS, NORMAN C., 2181 Briarwood Rd., Cleveland Heights, Ohio 1945
NELSON, ARNOLD L., 3256 Van Hazen St., N.W., Washington 15, D.C 1932
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NELSON, THEODORA, 315 E. 68th St., New York, N. Y 1929
NETTING, M. GRAHAM, Carnegie Museum, Pittsburgh 13, Penna 1934
†NEW, JOHN G., 340 W. 86th St., New York 24, N. Y 1948
†NEWBY, FLETCHER E., Trailer #12, M.S.U., Missoula, Mont 1948
†NEWEY, J. PAUL, 3848 Harrison Blvd., Ogden, Utah 1948
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OKKELBERG, PETER, 1220 Fair Oaks, Ann Arbor, Mich ..... Charter
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OLSON, ANDREW C., JR., 4412 Campus Ave., San Diego 3, Calif 1941
ONEY, JOHN, JR., 728 Union St., Brunswick, Ga 1947

ORR, ROBERT T., Calif. Academy of Sciences, San Francisco 18, Calif. 1931
OSBORN, CHASE S., Poulan, Worth County, Ga. 1925
OSBORN, DALE J., Union Post Office, Univ. Wyoming, Laramie, Wyo. 1948
OSBORN, JOHN A. L., 418 S. 5th St., Geneva, Ill. 1946
OSBORNE, RICHARD H., 624–34th Ave. North, Seattle 2, Wash. 1947
†OSBORNE, ROBERT C., 433 Chapel St., Hampton, Va. 1948
OSGOOD, FREDRICK L., JR., 17 Charles St., Rutland, Vt. 1933
OSTENSON, BURTON T., Dept. Biol., Pacific Lutheran College, Parkland, Wash. 1933
†OWEN, J. DOUGLAS, 3121 Arvia St., Los Angeles 31, Calif. 1948
PACKARD, FRED M., 34 Randolf St., Passaic, N. J. 1940
PACKCHANIAN, ARDZROONY, School of Medicine, Univ. Texas, Galveston, Tex. 1945
PALMER, E. LAWRENCE, Fernow Hall, Ithaca, N. Y. 1927
PALMER, FLETCHER G., Fullerton Jr. College, Fullerton, Calif. 1935
PALMER, RALPH S., Dept. Zool., Vassar College, Poughkeepsie, N. Y. 1938
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PARKER, JOHN R., 1757 Oxford St., Berkeley 9, Calif. 1946
†PARKER, ROBERT H., Box 21A, Edgewood Star Rt., Albuquerque, New Mex. 1948
PARROT, HADLEY, Hancock Point, Me. 1946
PARTCH, MAX L., R.F.D., Lake Mills, Wisc. 1938
PEABODY, FRANK E., Mus. Paleontology, Univ. Calif., Berkeley 4, Calif. 1947
PEARCE, JOHN, 1105 Blake Bldg., 59 Temple Pl., Boston, Mass. 1931
PEARSON, ALLEN M., P.O. Box 1031, Alabama Polytech. Inst., Auburn, Ala. 1938
PEARSON, OLIVER P., Mus. Vert. Zool., Univ. California, Berkeley 4, Calif. 1937
†PEARSON, PAUL G., 1634 West University Ave., Gainesville, Fla. 1948
PEARY, J. Y., Head of Ringling Bros. Zoofarm, Sarasota, Fla. 1941
PEQUEGNAT, WILLIS E., Dept. Zool., Pomona College, Claremont, Calif. 1941
PERRY, MARY L., 2412 Durant St., Berkeley 4, Calif. 1946
PETERS, JAMES L., Lane End, Harvard, Mass. ..... Charter
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PETTIT, LINCOLN C., 16 Buck St., Canton, N. Y. 1947
PETRIDES, GEORGE A., Wildlife Res. Unit, Ohio State Univ., Columbus, Ohio 1944
PETTINGILL, OLIN S., JR., Dept. Zool., Carlton College, Northfield, Minn. 1936
PFLUEGER, AL, Box 1328, North Miami, Fla. 1939
PHILIPS, RICHARD S., 834 Liberty St., Findlay, Ohio 1946
PHILLIPS, H. M., 5 Andrew Circle, Emory Univ., Ga. 1948
PHILLIPS, JOHN M., 2227 Jane St., Pittsburgh, Penna. ..... Charter
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PICKWELL, GAYLE B., State College, San Jose 14, Calif. 1926
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†PITTAWAY, B., Waterton Park, Alberta, Canada 1948
PO-CHEDLEY, DONALD S., 133 Midland Ave., Kenmore 17, N. Y. 1946
POILEY, SAMUEL M., Nat'l Inst. of Health, Rockville Pike, Bethesda, Md. 1947
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PORRO, THOMAS J., 718 Medical Arts Bldg., Tacoma, Wash. 1931
†PORTER, RICHARD D., 3265 Childs Ave., Ogden, Utah 1948
†POURNELL, GEORGE H., Dept. Biol., Univ. Fla., Gainesville, Fla. 1948
†POWELL, ERNEST H., Institute Marine Science, Port Aransas, Tex. 1948

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PREBLE, EDWARD A., 3027 Newark St., Washington 8, D. C. ..... Charter
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PRESNALL, CLIFFORD C., 5315 Earlston Dr., Washington 16, D. C. 1935
†PRICE, WALTER E., North Green St., Selma, N. C. 1948
PRIDDY, RALPH B., 53 Glenwood Ave., Newton Centre, Mass. 1941
PRUITT, WILLIAM O., JR., 908 E. Ann St., Ann Arbor, Mich. 1947
†QUAST, JAY C., 2616 Channing Way, Berkeley 4, Calif. 1948
QUAY, WILBUR B., Kinsman Rd., R.F.D. 3, Chagrin Falls, Ohio. 1946
QUIMBY, DON, 4742 Garfield Ave., So., Minneapolis 9, Minn. 1941
†RABB, EDWARD L., 1312 Ursuline Ave., Bryan, Tex. 1948
RABB, JOSEPH C., 46 S. 2W, Logan, Utah. 1940
RAFFERTY, ROBERT R., Rose Lake Wildlife Exp. Sta., R.D. #1, East Lansing, Mich. 1947
†RAMM, GORDON M., 17 Custer St., Buffalo 14, N. Y. 1948
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RAYNOR, GILBERT S., Long Island Ave., Manorville, N. Y. 1947
*REED, CHARLES A., Dept. Zool., Univ. Arizona, Tucson, Ariz. 1942
REEDER, WILLIAM G., 4725 Brynhurst Ave., Los Angeles 43, Calif. 1946
†REEVES, ROBERT B., 5722 Reach St., Philadelphia 20, Penna. 1948
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RICHMOND, NEIL D., 1324 Liberty St., Franklin, Penna. 1946
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†RIESE, WALTHER, Medical Coll. of Va., Richmond, Va. 1948
†RILEY, CHARLES V., R #1, Dover, Ohio. 1948
*RINDSFOOS, WILLIAM, 10 E. Broad St., Columbus, Ohio. ..... Charter
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RITER, WILLIAM E., Fish & Wildlife Serv., Washington 25, D. C. 1941
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ROBERTSON, HOWARD, 157 Wilton Dr., Los Angeles, Calif. ..... Charter
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ROBERTSON, RALPH A., 53 Tillotson Ave., Kenmore 17, N. Y. 1947
ROBIN, JOHN P., 213 Lytton Ave., Pittsburgh, Penna. 1946
ROBINETTE, W. LESLIE, 436 Federal Bldg., Salt Lake City 1, Utah. 1947
†ROBINSON, PAUL F., 139 Union St., Westfield, Mass. 1948
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ROUX, JORDAN S., 4442 Granger St., San Diego 7, Calif. ... 1947
ROWAN, WILLIAM, Univ. Alberta, Edmonton, Alberta. ... 1921
ROWLEY, J. STEWART, 424 N. Valencia, Alhambra, Calif. ... 1928
RUDD, ROBERT L., Mus. Vert. Zool., Univ. California, Berkeley 4, Calif. ... 1938
RUHL, H. D., Game Div., Dept. Conservation, Lansing, Mich. ... 1928
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SANDERSON, GLEN C., Missouri Coop. Wildlife Res. Unit, Columbia, Mo. ... 1947
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SAWYER, ELIZABETH L., Wesleyan College, Macon, Ga. ... 1936
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DE SCHAUENSEE, RODOLPHE M., Devon, Penna. ... 1931
SCHEFFER, VICTOR B., 2725 Montlake Blvd., Seattle 2, Wash. ... 1938
SCHERER, LLOYD E., JR., 2014 Kenwood Ave., Duluth 3, Minn. ... 1940
SCHLAIKJER, ERICH M., Dept. Geology, Brooklyn College, Bedford Ave. & Ave. H, Brooklyn, N. Y. ... 1931
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SCHWARTZ, ALBERT, Dept. Zool., Univ. Miami, Coral Gables 34, Fla. ... 1948
SCHWARZ, MAX D., 625 Tuxedo Blvd., Webster Groves 19, Mo. ... 1934
SCOTT, JOHN W., 1409 Garfield St., Laramie, Wyo. ... 1925
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SEALANDER, JOHN A., 203 Vivarium Bldg., Univ. Ill., Champaign, Ill. ... 1941
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SHACKLETON, WALTER H., Rt. 1, Box 76A, Prospect, Ky. ... 1947
SHADLE, ALBERT R., Univ. Buffalo, Buffalo 14, N. Y. ... 1925
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SHAPIRO, JACOB, N. Y. State Coll. of Forestry, Syracuse 10, N. Y. ... 1946
SHARP, WARD M., Red Rock Lakes Nat'l. Wildlife Refuge, Monida, Mont. ... 1936
SHAW, CHARLES R., 5601 Newport St., Baton Rouge 14, La. ... 1939
SHEARER, AMON R., Mont. Belview, Chambers Co., Tex. ... 1923
SHEFFIELD, JOHN M., 1872 Monroe Ave., New York 57, N. Y. ... 1945

SHELDON, W. GULLIVER, P.O. Box 103, Newfield, N. Y. ... 1933
SHELFORD, VICTOR E., Vivarium Bldg., Wright and Healey Sts., Champaign, Ill. ... 1923
SHEPPARD, WALTER B., 1060 Gaylord St., Denver, Colo. ... 1929
SHERMAN, HARLEY B., 2709 Univ. Ct., R.D. #2, Gainesville, Fla. ... Charter
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SIBLEY, CHARLES G., 1317 Walnut St., Berkeley 9, Calif. ... 1942
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SMELZER, MARILYN F., 189 Jewett Parkway, Apt. 5-3, Buffalo 14, N. Y. ... 1945
SMILEY, ALBERT K., JR., Mohonk Lake, N. Y. ... 1932
SMILEY, DANIEL, JR., Mohonk Lake, N. Y. ... 1931
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SMITH, CLARENCE F., 2623 Virginia St., Berkeley 4, Calif. ... 1936
SMITH, ELIZABETH W., Biol. Dept., Kent State Univ., Kent, Ohio. ... 1947
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SMITH, NATASHA D., 3704 Sylvan Place, Pinelawn 20, Mo. ... 1940
SMITH, PHIL S., Box 431, Cheney, Wash. ... 1947
SMITH, RALPH A., Dept. Zool., San Jose State College, San Jose 14, Calif. ... 1941
SMITH, WENDELL P., Wells River, Vt. ... 1927
SMYTH, THOMAS, State Teachers Coll., Shippensburg, Penna. ... 1947
SNEAD, I. EDWIN, P.O. Box 252, Lansing, Ia. ... 1947
SNYDER, DANA P., 207 Harker Hall, Univ. Illinois, Urbana, Ill. ... 1946
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SOLLBERGER, DWIGHT, Indiana State Teachers Coll., Indiana, Penna. ... 1938
SOOTER, CLARENCE A., P.O. Box 113, Oakley, Kans. ... 1938
SOPER, J. DEWEY, 827 Riverwood Ave., Fort Garry, Winnipeg, Manitoba, Canada. Charter
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TEETERS, ROBERT, 7608 New Second St., Melrose Park, Philadelphia 26, Penna. 1944
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TESLUK, IRENE, 7 Ontario St., Buffalo, N. Y. 1947
TERRES, J. KENNETH, 251 E. 48th St., New York 22, N. Y. 1935
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TOMICH, P. QUENTIN, Hastings Reservation, Jamesburg Route, Monterey, Calif. ... 1943
TOMKINS, IVAN R., 1231 E. 50th St., Savannah, Ga. ... 1930
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TORRE, LUIS DE LA, 813 Ridgewood Dr., Highland Park, Ill. ... 1942
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VAN DEUSEN, HOBART M., 12 Highland Ave., Montclair, N. J. ... 1946
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VAN DIEN, WALTER F., Rt. #4, Charlotte, Mich. ... 1947
VAN DYKE, HENRY, 809 E. Kingsley, Ann Arbor, Mich. ... 1947
†VAN GELDER, RICHARD G., 515 South Meldrum St., Fort Collins, Colo. ... 1948
VAN NORDHEIM, JACK H., 3352 Prospect, La Crescenta, Calif. ... 1942
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VESALL, DAVID B., 1403 Gordon Ave., W., Willmar, Minn. ... 1941
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VOGE, MARIETTA, 2626 Haste St., Berkeley, Calif. ... 1944
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WALKINSHAW, LAWRENCE H., 1703 Central Tower, Battle Creek, Mich. ... 1946
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†WILSON, JOHN E., 332 Magnolia St., Rochester, N. Y. 1948
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YOUNG, CHUNG CHIEN, Nat'l Geological Survey of China, 942 Chukiang Road, Nanking, China..... 1933
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ZIMMER, JOHN T., Amer. Mus. Nat. Hist., New York 24, N. Y.....Charter

COMMENT AND NEWS

SECTION ON "RECENT LITERATURE"

To assist the committee on bibliography with the important task of listing all references to mammalogical literature in the section of the Journal entitled "Recent Literature," numerous individuals volunteered at the last annual meeting to list mammalogical papers from particular publications. Some of those who volunteered were: David E. Davis for medical journals, W. R. Eadie and W. J. Hamilton, Jr., for experiment station reports, Lee R. Dice for Russian publications, C. E. Friley, Jr., for Mammalia, F. S. Barkalow, Jr., for French journals, D. D. MacLulich for the Canadian Journal of Research, and R. H. Manville for journals to be assigned.

Additional help will be welcomed by the committee. Individuals wishing to assist should consult with Dr. Remington Kellogg, chairman of the committee, U. S. National Museum, Washington 25, D. C., for details on a uniform system for recording such information.

SOCIETY OF SYSTEMATIC ZOOLOGISTS

The Society of Systematic Zoologists is in the process of being formed. An organizational meeting was held in Chicago, December 29, 1947, in connection with the A.A.A.S. The objectives of the new society shall be to promote the interests of taxonomy and systematic zoology, for both invertebrate and vertebrate animals, in museum and experimental work, and the scientific welfare of its members. The proposed society plans to exert its influence on taxonomic matters in national and international meetings, sponsor discussion or study groups to increase interest in the fundamental aspects of taxonomy, serve as a clearing house to obtain discussion and support of projects of interest or importance to taxonomists, and help bring taxonomists together for mutual benefit by issuing directories and news letters, encouraging the exchange of ideas, and holding an informal annual meeting for personal contact.

At the organizational meeting, Waldo L. Schmitt was elected president and G. W. Wharton, secretary-treasurer. Persons interested in joining should write Dr. G. W. Wharton, Dept. Zoology, Duke University, Durham, North Carolina.

EUROPEAN AID

The Committee on Aid to Europeans is urgently in need of additional donors for food and clothing. A few members have done, and are doing, more than their share. To them the Committee is deeply grateful. In the name of the Society, our colleagues in Europe have been promised aid. Let us distribute this obligation widely among our membership. If you wish to donate food, write Mrs. W. H. Burt, 1305 Henry St., Ann Arbor, Michigan. If you have clothing to donate, write Mrs. E. T. Hooper, 2391 Parkwood, Ann Arbor, Michigan, and she will let you know where to send it.

NEW FRONT COVER FOR JOURNAL

The Editorial Committee is considering the possibility of changing the design for the front cover of the Journal, starting with number 1 of volume 30. The Committee will be pleased to receive designs from artists and suggestions from those not artistically inclined. These should be in the office of the Editor by November 1, 1948. They will then be sent to the officers for comment and final decision. The only reward that the Society can offer, if a new design is accepted, is the prestige that it will bring to the artist.

DATE OF ISSUE OF PREVIOUS NUMBER

Vol. 29, No. 2, Journal of Mammalogy, mailed May 14, 1948

OBITUARY NOTICES

EDWARD PHELPS ALLIS

Word has been received from his son that Dr. Edward Phelps Allis, Jr., Life Member of the Society, died at Monaco March 8, 1947.

JAMES L. CHAWORTH-MUSTERS

James L. Chaworth-Musters died suddenly in April, 1948. At the time of his death he had in progress a manuscript on a check list of Palaearctic mammals.

R. BRUCE HORSFALL

R. Bruce Horsfall, noted animal artist, died on March 24, 1948. He was born at Clinton, Iowa, October 21, 1868.

EINAR LÖNNBERG

Dr. Einar Lönnberg, according to a note from his son, died in November, 1942.

EDWIN LINCOLN MOSELEY

Professor E. L. Moseley was born at Union City, Michigan, March 29, 1865. He died at Bowling Green, Ohio, June 6, 1948. Professor Moseley was one of our early Naturalists. Until the end, he maintained an active interest in all Nature. He was a Charter Member of the Society.

AUSTIN ROBERTS

A Charter Member of the Society, Austin Roberts, Transvaal Museum, Pretoria, South Africa, was killed in a motorcar accident the first week in May, 1948. Mr. Roberts was actively working on South African mammals, particularly on their taxonomy.

WILLIAM THOMAS SHAW

Dr. William T. Shaw, Charter Member of the Society, died at Fresno, California, May 13, 1948. Dr. Shaw was born at Woodburn, Ontario, February 10, 1873.

CARL M. STEENBERG

Dr. Carl M. Steenberg's widow writes from Copenhagen that her husband died February 1, 1946. Dr. Steenberg joined the Society in 1930.